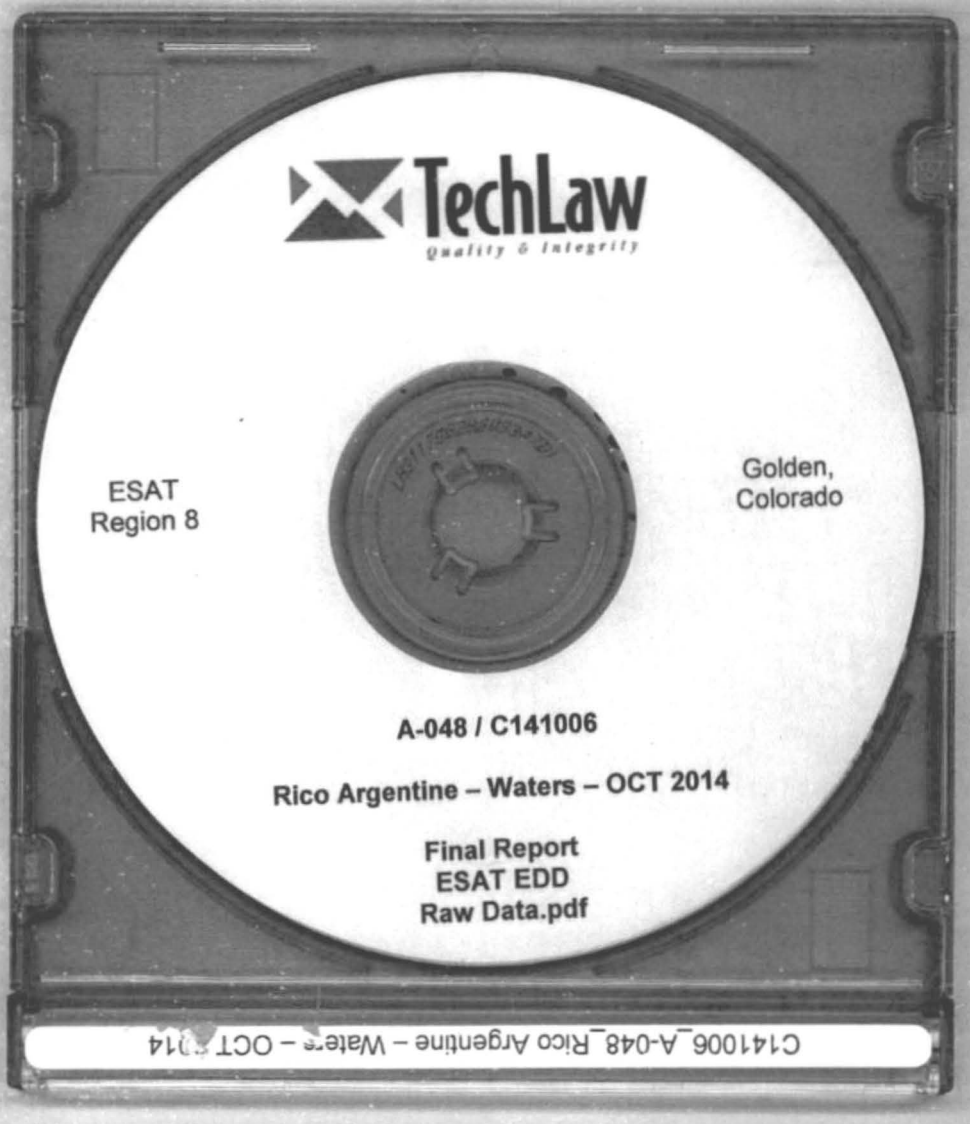
RIO-ARGENTINE-A-048-HC141996


TechLaw
quality & integrity
ESAT
Region 8
Golden,
Colorado
A-048 / C141006
Rico Argentine – Waters – OCT 2014
Final Report
ESAT EDD
Raw Data.pdf
C141006_A-048_Rico Argentine – Waters – OCT 2014

ESAT Region 8 Chain of Custody Form
U.S. Environmental Protection Agency
Region 8 Superfund Program

Site Name: Rico Argentine – Waters – OCT 2014 TDF: A-048

Site Manager: Steve Way Work Order: C141006

Sent to IC on 12/19

Relinquished By:

Print Name	Date	Signature
Holly J. Sprunger	12/10/14	

Received By:

Print Name	Date	Signature
Don Goodrich	12/19/14	

Relinquished By:

Print Name	Date	Signature
Don Goodrich	12/23/14	

Received By:

Print Name	Date	Signature

Relinquished By:

Print Name	Date	Signature

Received By:

Print Name	Date	Signature

TechLaw, Inc.
Environmental Services Assistance Team
16194 W. 45th Drive, Golden, CO 80403

Task Order:	0002 - Analytical Support and Data Validation
DCN#:	EP8 - 2 - 1089
Contract:	EP-W-13-028
TDF#:	A048
Line Item:	All
TDF Status:	In Progress
Date:	12/5/2014
To:	Don Goodrich, USEPA, Region 8 Task Order Project Officer
From:	Holly Sprunger, ESAT Environmental Scientist
Through:	Mark McDaniel, Region 8 ESAT Team Manager
Subject:	Rico Argentine_Waters_OCT 2014

Comments:

10/08/2014 Received 3 water samples for the following analyses:

Total Recoverable Metals by ICP-OE
Total Recoverable Metals by ICP-MS
Dissolved Metals / Hardness by ICP-OE
Dissolved Metals by ICP-MS

Thank You

U.S. Environmental Protection Agency
Region 8
Technical and Management Services

Laboratory Services Program

Certificate of Analysis

Ref: 8TMS-L

MEMORANDUM

Date: 12/04/14

Subject: Analytical Results--- **Rico-Argentine_Waters_OCT 2014_A048 / A-048**

From: Don Goodrich; EPA Region 8 Analytical Chemistry WAM

To: Steve Way
Superfund
1595 Wynkoop Street

Received Sample Set(s), [Work Order : Date Received]:
[C141006 : 10/08/2014]

Attached are the analytical results for the samples received from the Rico-Argentine_Waters_OCT 2014_A048 sampling event, according to TDF A-048. All analyses were performed within their method specified holding times unless otherwise noted in the following narrative.

These samples were prepared, analyzed, and verified by the Environmental Services Assistance Team Laboratory (ESAT) according to the requirements of the Technical Direction Form (TDF).

Note: The laboratory herewith transmits this deliverable to the program/project partner for determination of "final data usability" which may include data validation and data quality asessment per and in accordance with EPA QA/G-8, *Guidance on Environmental Data Verification and Data Validation*, November 2002, EPA/240/R-02/004. Laboratory data qualifiers are applied based on the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* October 2004, referred to as "NFGI".

Laboratory policy is to dispose of any remaining sample 60 days after data analysis packages are delivered to EPA. If you would like the laboratory to retain the samples for a period longer than 60 days, please contact Don Goodrich within the 60 day period at (303) 312-6687.

Case Narrative

C141006

Quality Assessment: Unless indicated by exception, the QA/QC associated with this sample set produced data within the TDF-specified criteria.

Holding Times: All samples were analyzed within their method-specified technical holding time(s).

1. Initial and Continuing calibration blanks (ICBs and CCBs).
   Exceptions: None.
2. Preparation (PB) / Method blanks (MB)
   Exceptions: None.
3. Interference Checks (ICSA / ICSAB) for ICP-MS and ICP-OE analyses only.
   Exceptions: None.
4. Initial and Continuing calibration verification analyses (ICVs, SCVs and CCVs).
   Exceptions: None.
5. Laboratory Control Sample (LCS) or second source analysis or SRM.
   Exceptions: None.
6. Laboratory Fortified blank (LFB) / Blank spike (BS), same source as used for the matrix spikes. PBS performed with analyses/methods requiring preparation or digestion prior to analysis.
   Exceptions: None.
7. Contract Reporting Detection Limit Standard, labeled as CRA, CRDL or CRL.
   Exceptions: None.
8. Laboratory Duplicate (DUP). "Source" identifies field sample duplicated in the laboratory. If either the "source" or the duplicate result is <5X the reporting limit, the %D limit of 20% does not apply.
   Exceptions: None.
9. Laboratory Matrix Spike (MS) and spike duplicate (MSD). "Source" defines original field sample fortified prior to analysis. Percent recovery (%R) limits do not apply when sample concentration(s) exceed the corresponding analyte spike level by a factor of 4 or greater.
   Exceptions: None.
10. Serial Dilution sample analysis (SRD). "Source" is parent field sample diluted 1:5 in the laboratory. Performed for ICP-OE and ICP-MS metals analyses. Percent difference (%D) limits do not apply when analyte concentration(s) are below 50x the source sample's MDL (or 10x it's PQL).
    Exceptions: None.
11. Internal standards, criteria specified for ICP-MS analyses only, monitored at the instrument.
    Exceptions: None.
12. Any calibration using more than two-points produced a correlation coefficient equal to or greater than 0.995.
    Exceptions: None.

Acronyms and Definitions:

ESAT	Environmental Services Assistance Team
J	Data Estimated qualifier (also applied to all data less than PQL, greater than or equal to MDL)
MDL	Method Detection Limit
PQL	Practical Quantitation Limit, also known as reporting limit.
RPD	Relative Percent Difference (difference divided by the mean)
%D	Percent difference, serial dilution criteria unit, difference divided by the original result.
%R	Percent recovery, analyzed (less sample contribution) divided by true value
<	Analyte NOT DETECTED at or above the Method Detection Limit (MDL)
mg/L	Parts per million (millligrams per liter). Solids equivalent = mg/Kg.
ug/L	Parts per billion (micrograms per liter). Solids equivalent = ug/Kg.
NR	No Recovery (matrix spike) - Often seen for calcium/magnesium when their concentration exceeds the spike level by > 4x.
NFGI	*USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, October 2004
RE	Sample Re-analysis. Usually seen on raw data and sequences for required sample dilutions due to over-range analytes.
U	Analyte not detected at or above MDL qualifier
D	Diluted value qualifier.

Method(s) Summary:

As defined in the Technical Direction Form (TDF), some or all of the methods listed below were used for the determination of the reported target analytes.

From EPA's *Methods for the Determination of Metals in Environmental Samples*, Supplement I, May 1994, dissolved, total, and/or total recoverable metals were determined by:

- Method 200.7 / 6010B using a PE Optima ICP -OE (ICP).
- Method 200.8 / 6020 using a Perkin -Elmer Elan 6000 ICP-MS.
- Method 200.2 for total recoverable metals (only) digestion.
- Method 245.1 using a Perkin -Elmer FIMS CVAA (aqueous mercury only).

From *Standard Methods for the Examination of Water and Wastewater*, 18th Edition, 1992, Method 2340B was used for the calculated hardness determination. Hardness is reported as mg (milligram) equivalent $CaCO_3$ per liter (L) determined as follows:

Calculated hardness = 2.497 * (Calcium, mg/L) + 4.118 * (Magnesium, mg/L).

From *EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW -846*,

- Method 3015A was used for microwave assisted total metals digestion.
- Method 7473 was used for mercury in solids.

From EPA's *Determination of Inorganic Anions by Ion Chromatography*, Revision 2.1, 1993, Method 300.0 was used to determine the anions.

From EPA's *Methods for Chemical Analysis of Water and Wastes*, March 1983:

- Method 310.1 was followed for the alkalinity determination.
- Method 160.1 was followed for gravimetric total dissolved solids (TDS) determination.
- Method 160.2 was used for gravimetric total suspended solids (TSS) determination.
- Method 415.3 was used for total organic carbon (TOC) determination using either an Apollo 9000 or Phoenix 8000 Non-Dispersive IR (NDIR) system. Also known as dissolved organic carbon (DOC) when performed on the dissolved sample fraction.

The quality control procedures listed in the TDF request were utilized by ESAT to verify accuracy of the results and to evaluate any matrix interferences.

Project Name: Rico-Argentine_Waters_OCT 2014_A048 **Certificate of Analysis**

TDF #: A-048

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: AC2EFF **Date / Time Sampled:** 10/07/14 09:35 **Workorder:** C141006
EPA Tag No.: 8-B **Matrix:** Surface Water **Lab Number:** C141006-02 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	Aluminum	< 50.0	U	ug/L	20.0	1	12/03/2014	SV	1412020
200.7	Beryllium	< 5.00	U	ug/L	2.00	1	12/03/2014	SV	1412020
200.7	**Calcium**	**241000**		ug/L	100	1	12/03/2014	SV	1412020
200.7	Iron	< 250	U	ug/L	100	1	12/03/2014	SV	1412020
200.7	**Magnesium**	**21100**		ug/L	100	1	12/03/2014	SV	1412020
200.7	**Manganese**	**2220**		ug/L	2.00	1	12/03/2014	SV	1412020
200.7	**Potassium**	**2280**		ug/L	250	1	12/03/2014	SV	1412020
200.7	**Sodium**	**9960**		ug/L	250	1	12/03/2014	SV	1412020
200.7	**Zinc**	**197**		ug/L	10.0	1	12/03/2014	SV	1412020
200.8	Antimony	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Arsenic	< 20.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	**Barium**	**99.6**	J	ug/L	50.0	10	12/03/2014	SV	1412021
200.8	Cadmium	< 2.00	U	ug/L	1.00	10	12/03/2014	SV	1412021
200.8	Chromium	< 20.0	U	ug/L	10.0	10	12/03/2014	SV	1412021
200.8	**Cobalt**	**1.18**	J	ug/L	1.00	10	12/03/2014	SV	1412021
200.8	Copper	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Lead	< 2.00	U	ug/L	1.00	10	12/03/2014	SV	1412021
200.8	Molybdenum	< 10.0	U	ug/L	10.0	10	12/03/2014	SV	1412021
200.8	Nickel	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Selenium	< 20.0	U	ug/L	10.0	10	12/03/2014	SV	1412021
200.8	Silver	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Thallium	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Vanadium	< 30.0	U	ug/L	20.0	10	12/03/2014	SV	1412021
2340B	**Hardness**	**688**		mg/L	2	1	12/03/2014	SV	1412020

Project Name: Rico-Argentine_Waters_OCT 2014_A048 **Certificate of Analysis**

TDF #: A-048

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: FDB **Date / Time Sampled:** 10/07/14 09:30 **Workorder:** C141006
EPA Tag No.: 8-B **Matrix:** Surface Water **Lab Number:** C141006-04 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**58.4**		ug/L	20.0	1	12/03/2014	SV	1412020
200.7	Beryllium	< 5.00	U	ug/L	2.00	1	12/03/2014	SV	1412020
200.7	**Calcium**	**232000**		ug/L	100	1	12/03/2014	SV	1412020
200.7	**Iron**	**378**		ug/L	100	1	12/03/2014	SV	1412020
200.7	**Magnesium**	**20300**		ug/L	100	1	12/03/2014	SV	1412020
200.7	**Manganese**	**2340**		ug/L	2.00	1	12/03/2014	SV	1412020
200.7	**Potassium**	**2080**		ug/L	250	1	12/03/2014	SV	1412020
200.7	**Sodium**	**10000**		ug/L	250	1	12/03/2014	SV	1412020
200.7	**Zinc**	**4680**		ug/L	10.0	1	12/03/2014	SV	1412020
200.8	Antimony	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Arsenic	< 20.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Barium	< 100	U	ug/L	50.0	10	12/03/2014	SV	1412021
200.8	**Cadmium**	**22.5**		ug/L	1.00	10	12/03/2014	SV	1412021
200.8	Chromium	< 20.0	U	ug/L	10.0	10	12/03/2014	SV	1412021
200.8	**Cobalt**	**3.74**		ug/L	1.00	10	12/03/2014	SV	1412021
200.8	**Copper**	**7.94**	J	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Lead	< 2.00	U	ug/L	1.00	10	12/03/2014	SV	1412021
200.8	**Molybdenum**	**13.7**		ug/L	10.0	10	12/03/2014	SV	1412021
200.8	Nickel	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Selenium	< 20.0	U	ug/L	10.0	10	12/03/2014	SV	1412021
200.8	Silver	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Thallium	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Vanadium	< 30.0	U	ug/L	20.0	10	12/03/2014	SV	1412021
2340B	**Hardness**	**662**		mg/L	2	1	12/03/2014	SV	1412020

Project Name: Rico-Argentine_Waters_OCT 2014_A048 **Certificate of Analysis**

TDF #: A-048

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: RDEFF **Date / Time Sampled:** 10/07/14 09:45 **Workorder:** C141006
EPA Tag No.: 8-B **Matrix:** Surface Water **Lab Number:** C141006-06 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**21.7**	J	ug/L	20.0	1	12/03/2014	SV	1412020
200.7	Beryllium	< 5.00	U	ug/L	2.00	1	12/03/2014	SV	1412020
200.7	**Calcium**	**239000**		ug/L	100	1	12/03/2014	SV	1412020
200.7	Iron	< 250	U	ug/L	100	1	12/03/2014	SV	1412020
200.7	**Magnesium**	**23800**		ug/L	100	1	12/03/2014	SV	1412020
200.7	**Manganese**	**1830**		ug/L	2.00	1	12/03/2014	SV	1412020
200.7	**Potassium**	**9320**		ug/L	250	1	12/03/2014	SV	1412020
200.7	**Sodium**	**11200**		ug/L	250	1	12/03/2014	SV	1412020
200.7	**Zinc**	**67.0**		ug/L	10.0	1	12/03/2014	SV	1412020
200.8	Antimony	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Arsenic	< 20.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	**Barium**	**90.8**	J	ug/L	50.0	10	12/03/2014	SV	1412021
200.8	Cadmium	< 2.00	U	ug/L	1.00	10	12/03/2014	SV	1412021
200.8	Chromium	< 20.0	U	ug/L	10.0	10	12/03/2014	SV	1412021
200.8	**Cobalt**	**1.03**	J	ug/L	1.00	10	12/03/2014	SV	1412021
200.8	Copper	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Lead	< 2.00	U	ug/L	1.00	10	12/03/2014	SV	1412021
200.8	Molybdenum	< 10.0	U	ug/L	10.0	10	12/03/2014	SV	1412021
200.8	Nickel	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Selenium	< 20.0	U	ug/L	10.0	10	12/03/2014	SV	1412021
200.8	Silver	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Thallium	< 10.0	U	ug/L	5.00	10	12/03/2014	SV	1412021
200.8	Vanadium	< 30.0	U	ug/L	20.0	10	12/03/2014	SV	1412021
2340B	**Hardness**	**695**		mg/L	2	1	12/03/2014	SV	1412020

"J" Qualifier indicates an estimated value

Project Name: Rico-Argentine_Waters_OCT 2014_A048 **Certificate of Analysis**

TDF #: A-048

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: AC2EFF **Date / Time Sampled:** 10/07/14 09:35 **Workorder:** C141006
EPA Tag No.: 8-A **Matrix:** Surface Water **Lab Number:** C141006-01 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**21.2**	J	ug/L	20.0	1	12/04/2014	SV	1412012
200.7	Beryllium	< 5.00	U	ug/L	2.00	1	12/04/2014	SV	1412012
200.7	**Calcium**	**234000**		ug/L	100	1	12/04/2014	SV	1412012
200.7	**Iron**	**154**	J	ug/L	100	1	12/04/2014	SV	1412012
200.7	**Magnesium**	**20600**		ug/L	100	1	12/04/2014	SV	1412012
200.7	**Manganese**	**2210**		ug/L	2.00	1	12/04/2014	SV	1412012
200.7	**Potassium**	**2260**		ug/L	250	1	12/04/2014	SV	1412012
200.7	**Sodium**	**9750**		ug/L	250	1	12/04/2014	SV	1412012
200.7	**Zinc**	**770**		ug/L	10.0	1	12/04/2014	SV	1412012
200.8	Antimony	< 10.0	U	ug/L	5.00	10	12/04/2014	SV	1412012
200.8	Arsenic	< 20.0	U	ug/L	5.00	10	12/04/2014	SV	1412012
200.8	**Barium**	**98.4**	J	ug/L	50.0	10	12/04/2014	SV	1412012
200.8	Cadmium	< 2.00	U	ug/L	1.00	10	12/04/2014	SV	1412012
200.8	Chromium	< 20.0	U	ug/L	10.0	10	12/04/2014	SV	1412012
200.8	Cobalt	< 2.00	U	ug/L	1.00	10	12/04/2014	SV	1412012
200.8	Copper	< 10.0	U	ug/L	5.00	10	12/04/2014	SV	1412012
200.8	Lead	< 2.00	U	ug/L	1.00	10	12/04/2014	SV	1412012
200.8	Molybdenum	< 10.0	U	ug/L	10.0	10	12/04/2014	SV	1412012
200.8	Nickel	< 10.0	U	ug/L	5.00	10	12/04/2014	SV	1412012
200.8	Selenium	< 20.0	U	ug/L	10.0	10	12/04/2014	SV	1412012
200.8	Silver	< 10.0	U	ug/L	5.00	10	12/04/2014	SV	1412012
200.8	Thallium	< 10.0	U	ug/L	5.00	10	12/04/2014	SV	1412012
200.8	Vanadium	< 30.0	U	ug/L	20.0	10	12/04/2014	SV	1412012

Project Name: Rico-Argentine_Waters_OCT 2014_A048 **Certificate of Analysis**

TDF #: A-048

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: FDB **Date / Time Sampled:** 10/07/14 09:30 **Workorder:** C141006
EPA Tag No.: 8-A **Matrix:** Surface Water **Lab Number:** C141006-03 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**337**		ug/L	20.0	1	12/04/2014	SV	1412012
200.7	Beryllium	< 5.00	U	ug/L	2.00	1	12/04/2014	SV	1412012
200.7	**Calcium**	**226000**		ug/L	100	1	12/04/2014	SV	1412012
200.7	**Iron**	**4110**		ug/L	100	1	12/04/2014	SV	1412012
200.7	**Magnesium**	**19700**		ug/L	100	1	12/04/2014	SV	1412012
200.7	**Manganese**	**2320**		ug/L	2.00	1	12/04/2014	SV	1412012
200.7	**Potassium**	**2010**		ug/L	250	1	12/04/2014	SV	1412012
200.7	**Sodium**	**9700**		ug/L	250	1	12/04/2014	SV	1412012
200.7	**Zinc**	**4490**		ug/L	10.0	1	12/04/2014	SV	1412012
200.8	Antimony	< 5.00	U	ug/L	2.50	5	12/04/2014	SV	1412012
200.8	Arsenic	< 10.0	U	ug/L	2.50	5	12/04/2014	SV	1412012
200.8	Barium	< 50.0	U	ug/L	25.0	5	12/04/2014	SV	1412012
200.8	**Cadmium**	**12.3**		ug/L	0.500	5	12/04/2014	SV	1412012
200.8	Chromium	< 10.0	U	ug/L	5.00	5	12/04/2014	SV	1412012
200.8	**Cobalt**	**1.88**		ug/L	0.500	5	12/04/2014	SV	1412012
200.8	**Copper**	**28.6**		ug/L	2.50	5	12/04/2014	SV	1412012
200.8	**Lead**	**1.72**		ug/L	0.500	5	12/04/2014	SV	1412012
200.8	**Molybdenum**	**9.06**		ug/L	5.00	5	12/04/2014	SV	1412012
200.8	Nickel	< 5.00	U	ug/L	2.50	5	12/04/2014	SV	1412012
200.8	Selenium	< 10.0	U	ug/L	5.00	5	12/04/2014	SV	1412012
200.8	Silver	< 5.00	U	ug/L	2.50	5	12/04/2014	SV	1412012
200.8	**Thallium**	**5.62**		ug/L	2.50	5	12/04/2014	SV	1412012
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	12/04/2014	SV	1412012

Project Name: Rico-Argentine_Waters_OCT 2014_A048 **Certificate of Analysis**

TDF #: A-048

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: RDEFF **Date / Time Sampled:** 10/07/14 09:45 **Workorder:** C141006
EPA Tag No.: 8-A **Matrix:** Surface Water **Lab Number:** C141006-05 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**38.4**	J	ug/L	20.0	1	12/04/2014	SV	1412012
200.7	Beryllium	< 5.00	U	ug/L	2.00	1	12/04/2014	SV	1412012
200.7	**Calcium**	**234000**		ug/L	100	1	12/04/2014	SV	1412012
200.7	Iron	< 250	U	ug/L	100	1	12/04/2014	SV	1412012
200.7	**Magnesium**	**23400**		ug/L	100	1	12/04/2014	SV	1412012
200.7	**Manganese**	**1810**		ug/L	2.00	1	12/04/2014	SV	1412012
200.7	**Potassium**	**9120**		ug/L	250	1	12/04/2014	SV	1412012
200.7	**Sodium**	**10900**		ug/L	250	1	12/04/2014	SV	1412012
200.7	**Zinc**	**747**		ug/L	10.0	1	12/04/2014	SV	1412012
200.8	Antimony	< 5.00	U	ug/L	2.50	5	12/04/2014	SV	1412012
200.8	Arsenic	< 10.0	U	ug/L	2.50	5	12/04/2014	SV	1412012
200.8	**Barium**	**46.2**	J	ug/L	25.0	5	12/04/2014	SV	1412012
200.8	**Cadmium**	**0.773**	J	ug/L	0.500	5	12/04/2014	SV	1412012
200.8	Chromium	< 10.0	U	ug/L	5.00	5	12/04/2014	SV	1412012
200.8	Cobalt	< 1.00	U	ug/L	0.500	5	12/04/2014	SV	1412012
200.8	Copper	< 5.00	U	ug/L	2.50	5	12/04/2014	SV	1412012
200.8	Lead	< 1.00	U	ug/L	0.500	5	12/04/2014	SV	1412012
200.8	Molybdenum	< 5.00	U	ug/L	5.00	5	12/04/2014	SV	1412012
200.8	Nickel	< 5.00	U	ug/L	2.50	5	12/04/2014	SV	1412012
200.8	Selenium	< 10.0	U	ug/L	5.00	5	12/04/2014	SV	1412012
200.8	Silver	< 5.00	U	ug/L	2.50	5	12/04/2014	SV	1412012
200.8	Thallium	< 5.00	U	ug/L	2.50	5	12/04/2014	SV	1412012
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	12/04/2014	SV	1412012

"J" Qualifier indicates an estimated value

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
ICPMS-PE DRC-II									
Batch 1412021 - No Lab Prep Reqd			*Water*						ICPMS-PE DRC-II
Method Blank (1412021-BLK1)		Dilution Factor: 1					Prepared & Analyzed: 12/03/14		
Vanadium	< 2.00	3.00	ug/L						
Chromium	< 1.00	2.00	"						
Cobalt	< 0.100	0.200	"						
Nickel	< 0.500	1.00	"						
Copper	< 0.500	1.00	"						
Arsenic	< 0.500	2.00	"						
Selenium	< 1.00	2.00	"						
Molybdenum	< 1.00	1.00	"						
Silver	< 0.500	1.00	"						
Cadmium	< 0.100	0.200	"						
Antimony	< 0.500	1.00	"						
Barium	< 5.00	10.0	"						
Thallium	< 0.500	1.00	"						
Lead	< 0.100	0.200	"						
Method Blank Spike (1412021-BS1)		Dilution Factor: 1					Prepared & Analyzed: 12/03/14		
Vanadium	94.8	3.00	ug/L	100		95	85-115		
Chromium	97.5	2.00	"	100		97	85-115		
Cobalt	92.5	0.200	"	100		92	85-115		
Nickel	93.1	1.00	"	100		93	85-115		
Copper	93.8	1.00	"	100		94	85-115		
Arsenic	90.8	2.00	"	100		91	85-115		
Selenium	489	2.00	"	500		98	85-115		
Molybdenum	97.5	1.00	"	100		97	85-115		
Silver	97.5	1.00	"	100		97	85-115		
Cadmium	97.4	0.200	"	100		97	85-115		
Antimony	101	1.00	"	100		101	85-115		
Barium	96.4	10.0	"	100		96	85-115		
Thallium	98.4	1.00	"	100		98	85-115		
Lead	96.9	0.200	"	100		97	85-115		

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1412021 - No Lab Prep Reqd			*Water*						ICPMS-PE DRC-II
Duplicate (1412021-DUP1)		Dilution Factor: 1	Source: C141006-02			Prepared & Analyzed: 12/03/14			
Vanadium	< 20.0	30.0	ug/L		< 20.0				20
Chromium	< 10.0	20.0	"		< 10.0				20
Cobalt	1.12	2.00	"		1.18			5	20
Nickel	< 5.00	10.0	"		< 5.00				20
Copper	< 5.00	10.0	"		< 5.00				20
Arsenic	< 5.00	20.0	"		< 5.00				20
Selenium	< 10.0	20.0	"		< 10.0				20
Molybdenum	< 10.0	10.0	"		< 10.0				20
Silver	< 5.00	10.0	"		< 5.00				20
Cadmium	< 1.00	2.00	"		< 1.00				20
Antimony	< 5.00	10.0	"		< 5.00				20
Barium	98.0	100	"		99.6			2	20
Thallium	< 5.00	10.0	"		< 5.00				20
Lead	< 1.00	2.00	"		< 1.00				20
Matrix Spike (1412021-MS1)		Dilution Factor: 1	Source: C141006-02			Prepared & Analyzed: 12/03/14			
Vanadium	89.1	30.0	ug/L	100	< 20.0	89	70-130		
Chromium	92.5	20.0	"	100	< 10.0	92	70-130		
Cobalt	87.6	2.00	"	100	1.18	86	70-130		
Nickel	80.4	10.0	"	100	< 5.00	80	70-130		
Copper	83.8	10.0	"	100	< 5.00	84	70-130		
Arsenic	81.8	20.0	"	100	< 5.00	82	70-130		
Selenium	419	20.0	"	500	< 10.0	84	70-130		
Molybdenum	94.1	10.0	"	100	< 10.0	94	70-130		
Silver	81.3	10.0	"	100	< 5.00	81	70-130		
Cadmium	96.2	2.00	"	100	< 1.00	96	70-130		
Antimony	98.9	10.0	"	100	< 5.00	99	70-130		
Barium	194	100	"	100	99.6	95	70-130		
Thallium	93.6	10.0	"	100	< 5.00	94	70-130		
Lead	92.5	2.00	"	100	< 1.00	92	70-130		

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1412025 - 1412021			*Water*						ICPMS-PE DRC-II
Serial Dilution (1412025-SRD1)		Dilution Factor: 5	Source: C141006-02		Prepared & Analyzed: 12/03/14				
Vanadium	< 100	150	ug/L		< 20.00				10
Chromium	< 50.0	100	"		< 10.00				10
Cobalt	< 5.00	10.0	"		1.18				10
Nickel	< 25.0	50.0	"		< 5.00				10
Copper	< 25.0	50.0	"		< 5.00				10
Arsenic	< 25.0	100	"		< 5.00				10
Selenium	< 50.0	100	"		< 10.00				10
Molybdenum	< 50.0	50.0	"		< 10.00				10
Silver	< 25.0	50.0	"		< 5.00				10
Cadmium	< 5.00	10.0	"		< 1.00				10
Antimony	< 25.0	50.0	"		< 5.00				10
Barium	< 250	500	"		99.6				10
Thallium	< 25.0	50.0	"		< 5.00				10
Lead	< 5.00	10.0	"		< 1.00				10
ICPOE - PE Optima									
Batch 1412020 - No Lab Prep Reqd			*Water*						ICPOE - PE Optima
Method Blank (1412020-BLK1)		Dilution Factor: 1			Prepared & Analyzed: 12/03/14				
Aluminum	< 20.0	50.0	ug/L						
Beryllium	< 2.00	5.00	"						
Calcium	< 100	250	"						
Iron	< 100	250	"						
Potassium	< 250	1000	"						
Magnesium	< 100	250	"						
Manganese	< 2.00	5.00	"						
Sodium	< 250	1000	"						
Zinc	< 10.0	20.0	"						

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1412020 - No Lab Prep Reqd			*Water*						ICPOE - PE Optima
Method Blank Spike (1412020-BS1)		Dilution Factor: 1				Prepared & Analyzed: 12/03/14			
Aluminum	10410	50.0	ug/L	10100		103	85-115		
Beryllium	102.7	5.00	"	100		103	85-115		
Calcium	10290	250	"	10100		102	85-115		
Iron	10330	250	"	10100		102	85-115		
Potassium	10530	1000	"	10100		104	85-115		
Magnesium	10390	250	"	10100		103	85-115		
Manganese	102.1	5.00	"	100		102	85-115		
Sodium	10450	1000	"	10100		103	85-115		
Zinc	100.0	20.0	"	100		100	85-115		
Duplicate (1412020-DUP1)		Dilution Factor: 1	Source: C141006-02			Prepared & Analyzed: 12/03/14			
Aluminum	21.11	50.0	ug/L		< 20.0				20
Beryllium	< 2.00	5.00	"		< 2.00				20
Calcium	240700	250	"		240700			0.02	20
Iron	< 100	250	"		< 100				20
Potassium	2322	1000	"		2277			2	20
Magnesium	21300	250	"		21060			1	20
Manganese	2215	5.00	"		2222			0.3	20
Sodium	10160	1000	"		9961			2	20
Zinc	201.3	20.0	"		197.0			2	20
Matrix Spike (1412020-MS1)		Dilution Factor: 1	Source: C141006-02			Prepared & Analyzed: 12/03/14			
Aluminum	10580	50.0	ug/L	10100	< 20.0	105	70-130		
Beryllium	103.3	5.00	"	100	< 2.00	103	70-130		
Calcium	243300	250	"	10100	240700	25	70-130		
Iron	10220	250	"	10100	< 100	101	70-130		
Potassium	13170	1000	"	10100	2277	108	70-130		
Magnesium	30730	250	"	10100	21060	96	70-130		
Manganese	2240	5.00	"	100	2222	18	70-130		
Sodium	20260	1000	"	10100	9961	102	70-130		
Zinc	283.2	20.0	"	100	197.0	86	70-130		

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1412023 - 1412020			*Water*						ICPOE - PE Optima
Serial Dilution (1412023-SRD1)		Dilution Factor: 5	Source: C141006-02		Prepared & Analyzed: 12/03/14				
Aluminum	< 100	250	ug/L		< 20.00				10
Beryllium	< 10.0	25.0	"		< 2.00				10
Calcium	231000	1250	"		240700			4	10
Iron	< 500	1250	"		< 100.00				10
Potassium	1964	5000	"		2277			15	10
Magnesium	20590	1250	"		21060			2	10
Manganese	2273	25.0	"		2222			2	10
Sodium	9636	5000	"		9961			3	10
Zinc	199.8	100	"		197.0			1	10

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference; %D = % Difference, DL = Detection Limit for QC sample

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
ICPMS-PE DRC-II									
Batch 1412012 - 200.2 - TR Metals			*Water*						**ICPMS-PE DRC-II**
Method Blank (1412012-BLK2)		Dilution Factor: 5					Prepared: 12/01/14 Analyzed: 12/04/14		
Vanadium	< 10.0	15.0	ug/L						
Chromium	< 5.00	10.0	"						
Cobalt	< 0.500	1.00	"						
Nickel	< 2.50	5.00	"						
Copper	< 2.50	5.00	"						
Arsenic	< 2.50	10.0	"						
Selenium	< 5.00	10.0	"						
Molybdenum	< 5.00	5.00	"						
Silver	< 2.50	5.00	"						
Cadmium	< 0.500	1.00	"						
Antimony	< 2.50	5.00	"						
Barium	< 25.0	50.0	"						
Thallium	< 2.50	5.00	"						
Lead	< 0.500	1.00	"						
Duplicate (1412012-DUP2)		Dilution Factor: 1	Source: C141006-01				Prepared: 12/01/14 Analyzed: 12/04/14		
Vanadium	< 20.0	30.0	ug/L		< 20.0				20
Chromium	< 10.0	20.0	"		< 10.0				20
Cobalt	< 1.00	2.00	"		< 1.00				20
Nickel	< 5.00	10.0	"		< 5.00				20
Copper	< 5.00	10.0	"		< 5.00				20
Arsenic	< 5.00	20.0	"		< 5.00				20
Selenium	< 10.0	20.0	"		< 10.0				20
Molybdenum	< 10.0	10.0	"		< 10.0				20
Silver	< 5.00	10.0	"		< 5.00				20
Cadmium	1.048	2.00	"		< 1.00				20
Antimony	< 5.00	10.0	"		< 5.00				20
Barium	99.72	100	"		98.35			1	20
Thallium	< 5.00	10.0	"		< 5.00				20
Lead	< 1.00	2.00	"		< 1.00				20

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1412012 - 200.2 - TR Metals			*Water*						ICPMS-PE DRC-II
Matrix Spike (1412012-MS2)		Dilution Factor: 1		Source: C141006-01			Prepared: 12/01/14 Analyzed: 12/04/14		
Vanadium	273.1	30.0	ug/L	300	< 20.0	91	70-130		
Chromium	381.1	20.0	"	400	< 10.0	95	70-130		
Cobalt	188.3	2.00	"	200	< 1.00	94	70-130		
Nickel	450.1	10.0	"	500	< 5.00	90	70-130		
Copper	282.4	10.0	"	300	< 5.00	94	70-130		
Arsenic	800.9	20.0	"	800	< 5.00	100	70-130		
Selenium	1672	20.0	"	2000	< 10.0	84	70-130		
Molybdenum	405.2	10.0	"	400	< 10.0	101	70-130		
Silver	74.93	10.0	"	75.0	< 5.00	100	70-130		
Cadmium	203.8	2.00	"	200	< 1.00	102	70-130		
Antimony	826.3	10.0	"	800	< 5.00	103	70-130		
Barium	290.2	100	"	200	98.35	96	70-130		
Thallium	1890	10.0	"	2000	< 5.00	94	70-130		
Lead	955.4	2.00	"	1000	< 1.00	96	70-130		
Reference (1412012-SRM2)		Dilution Factor: 2					Prepared: 12/01/14 Analyzed: 12/04/14		
Vanadium	954.1	60.0	ug/L	1000		95	85-115		
Chromium	991.0	40.0	"	1000		99	85-115		
Cobalt	984.1	4.00	"	1000		98	85-115		
Nickel	954.3	20.0	"	1000		95	85-115		
Copper	989.2	20.0	"	1000		99	85-115		
Arsenic	2010	40.0	"	2000		100	85-115		
Selenium	1006	40.0	"	1000		101	85-115		
Molybdenum	973.2	20.0	"	1000		97	85-115		
Silver	248.9	20.0	"	250		100	85-115		
Cadmium	1013	4.00	"	1000		101	85-115		
Antimony	2054	20.0	"	2000		103	85-115		
Barium	975.2	200	"	1000		98	85-115		
Thallium	4776	20.0	"	5000		96	85-115		
Lead	1911	4.00	"	2000		96	85-115		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1412033 - 1412012			*Water*						ICPMS-PE DRC-II
Serial Dilution (1412033-SRD1)		Dilution Factor: 5	Source: C141006-01					Prepared: 12/01/14 Analyzed: 12/04/14	
Vanadium	< 100	150	ug/L		< 20.00				10
Chromium	< 50.0	100	"		< 10.00				10
Cobalt	< 5.00	10.0	"		< 1.00				10
Nickel	< 25.0	50.0	"		< 5.00				10
Copper	< 25.0	50.0	"		< 5.00				10
Arsenic	< 25.0	100	"		< 5.00				10
Selenium	< 50.0	100	"		< 10.00				10
Molybdenum	< 50.0	50.0	"		< 10.00				200
Silver	< 25.0	50.0	"		< 5.00				10
Cadmium	< 5.00	10.0	"		< 1.00				10
Antimony	< 25.0	50.0	"		< 5.00				10
Barium	< 250	500	"		98.35				10
Thallium	< 25.0	50.0	"		< 5.00				10
Lead	< 5.00	10.0	"		< 1.00				10

ICPOE - PE Optima

Batch 1412012 - 200.2 - TR Metals			*Water*						ICPOE - PE Optima
Method Blank (1412012-BLK1)		Dilution Factor: 1						Prepared: 12/01/14 Analyzed: 12/04/14	
Aluminum	< 20.0	50.0	ug/L						
Beryllium	< 2.00	5.00	"						
Calcium	< 100	250	"						
Iron	< 100	250	"						
Potassium	< 250	1000	"						
Magnesium	< 100	250	"						
Manganese	< 2.00	5.00	"						
Sodium	< 250	1000	"						
Zinc	< 10.0	20.0	"						

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1412012 - 200.2 - TR Metals			*Water*						ICPOE - PE Optima
Duplicate (1412012-DUP1)		Dilution Factor: 1	Source: C141006-01				Prepared: 12/01/14 Analyzed: 12/04/14		
Aluminum	23.32	50.0	ug/L		21.24			9	20
Beryllium	< 2.00	5.00	"		< 2.00				20
Calcium	237100	250	"		234000			1	20
Iron	112.5	250	"		154.4			31	20
Potassium	2284	1000	"		2260			1	20
Magnesium	20810	250	"		20590			1	20
Manganese	2198	5.00	"		2214			0.7	20
Sodium	9827	1000	"		9751			0.8	20
Zinc	768.0	20.0	"		769.8			0.2	20
Matrix Spike (1412012-MS1)		Dilution Factor: 1	Source: C141006-01				Prepared: 12/01/14 Analyzed: 12/04/14		
Aluminum	1925	50.0	ug/L	2000	21.24	95	70-130		
Beryllium	197.3	5.00	"	200	< 2.00	99	70-130		
Calcium	237500	250	"	1000	234000	354	70-130		
Iron	2973	250	"	3000	154.4	94	70-130		
Potassium	12600	1000	"	10000	2260	103	70-130		
Magnesium	22580	250	"	2000	20590	100	70-130		
Manganese	2379	5.00	"	200	2214	83	70-130		
Sodium	12710	1000	"	3000	9751	99	70-130		
Zinc	936.4	20.0	"	200	769.8	83	70-130		
Reference (1412012-SRM1)		Dilution Factor: 1					Prepared: 12/01/14 Analyzed: 12/04/14		
Aluminum	927.3	50.0	ug/L	1000		93	85-115		
Beryllium	996.2	5.00	"	1000		100	85-115		
Calcium	927.1	250	"	1000		93	85-115		
Iron	933.7	250	"	1000		93	85-115		
Potassium	4719	1000	"	5000		94	85-115		
Magnesium	979.3	250	"	1000		98	85-115		
Manganese	1044	5.00	"	1000		104	85-115		
Sodium	938.3	1000	"	1000		94	85-115		
Zinc	959.4	20.0	"	1000		96	85-115		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1412031 - 1412012			*Water*						ICPOE - PE Optima
Serial Dilution (1412031-SRD1)		Dilution Factor: 5	Source: C141006-01			Prepared: 12/01/14 Analyzed: 12/04/14			
Aluminum	< 100	250	ug/L		21.24				10
Beryllium	< 10.0	25.0	"		< 2.00				10
Calcium	230200	1250	"		234000			2	10
Iron	< 500	1250	"		154.4				10
Potassium	2035	5000	"		2260			10	10
Magnesium	20720	1250	"		20590			0.6	10
Manganese	2282	25.0	"		2214			3	10
Sodium	9631	5000	"		9751			1	10
Zinc	795.9	100	"		769.8			3	10

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference. %D = % Difference. DL = Detection Limit for QC sample

Project Name: Rico-Argentine_Waters_OCT 2014_A048 Certificate of Analysis

TDF #: A-048

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Diss. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C141006

Analytical Sequence: 1412023 Dissolved Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Aluminum	-0.37	1	2	3	4	1412020-BLK1	NA	50.00
		2.06				-0.76	NA	
		5	6	7	8			
Beryllium	0.56	1	2	3	4	1412020-BLK1	NA	5.00
		0.41				0.45	NA	
		5	6	7	8			
Calcium	0.23	1	2	3	4	1412020-BLK1	NA	250.00
		8.25				13.36	NA	
		5	6	7	8			
Iron	5.80	1	2	3	4	1412020-BLK1	NA	250.00
		29.69				53.66	NA	
		5	6	7	8			
Potassium	24.12	1	2	3	4	1412020-BLK1	NA	1,000.00
		21.84				23.33	NA	
		5	6	7	8			
Magnesium	-0.47	1	2	3	4	1412020-BLK1	NA	250.00
		1.98				-5.58	NA	
		5	6	7	8			
Manganese	0.12	1	2	3	4	1412020-BLK1	NA	5.00
		0.17				-0.09	NA	
		5	6	7	8			
Sodium	0.73	1	2	3	4	1412020-BLK1	NA	1,000.00
		6.62				10.82	NA	
		5	6	7	8			

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TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Diss. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C141006

Analytical Sequence: 1412023 Dissolved Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1412020-BLK1	NA	
Zinc	1.01	-0.78				0.96	NA	20.00
		5	6	7	8			

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TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.8 Analysis Name: ICPMS Diss. Metals

Instrument: ICPMS-PE DRC-II Work Order: Nu C141006

Analytical Sequence: 1412025 Dissolved Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Vanadium	0.14	1	2	3	4	1412021-BLK1	NA	3.00
		0.05				-0.08	NA	
		5	6	7	8			
Chromium	-0.07	1	2	3	4	1412021-BLK1	NA	2.00
		-0.07				-0.27	NA	
		5	6	7	8			
Cobalt	0.01	1	2	3	4	1412021-BLK1	NA	0.20
		0.01				0.00	NA	
		5	6	7	8			
Nickel	0.02	1	2	3	4	1412021-BLK1	NA	1.00
		0.00				-0.02	NA	
		5	6	7	8			
Copper	0.02	1	2	3	4	1412021-BLK1	NA	1.00
		0.01				-0.05	NA	
		5	6	7	8			
Arsenic	-0.05	1	2	3	4	1412021-BLK1	NA	2.00
		0.06				0.04	NA	
		5	6	7	8			
Selenium	0.10	1	2	3	4	1412021-BLK1	NA	2.00
		0.09				0.19	NA	
		5	6	7	8			
Molybdenum	0.21	1	2	3	4	1412021-BLK1	NA	1.00
		0.12				0.70	NA	
		5	6	7	8			

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.8 Analysis Name: ICPMS Diss. Metals

Instrument: ICPMS-PE DRC-II Work Order: Nu C141006

Analytical Sequence: 1412025 Dissolved Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Silver	0.04	1	2	3	4	1412021-BLK1	NA	1.00
		0.04				0.03	NA	
		5	6	7	8			
Cadmium	0.02	1	2	3	4	1412021-BLK1	NA	0.20
		0.03				0.01	NA	
		5	6	7	8			
Antimony	0.14	1	2	3	4	1412021-BLK1	NA	1.00
		0.22				0.13	NA	
		5	6	7	8			
Barium	0.00	1	2	3	4	1412021-BLK1	NA	10.00
		0.00				-0.02	NA	
		5	6	7	8			
Thallium	0.01	1	2	3	4	1412021-BLK1	NA	1.00
		0.01				-0.05	NA	
		5	6	7	8			
Lead	0.01	1	2	3	4	1412021-BLK1	NA	0.20
		0.01				0.01	NA	
		5	6	7	8			

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C141006

Analytical Sequence: 1412031 **Total Recoverable** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Aluminum	2.08	1	2	3	4	1412012-BLK1	NA	50.00
		4.06				3.35	NA	
		5	6	7	8			
Beryllium	0.18	1	2	3	4	1412012-BLK1	NA	5.00
		0.14				-0.09	NA	
		5	6	7	8			
Calcium	-2.52	1	2	3	4	1412012-BLK1	NA	250.00
		2.34				12.14	NA	
		5	6	7	8			
Iron	34.00	1	2	3	4	1412012-BLK1	NA	250.00
		25.69				44.93	NA	
		5	6	7	8			
Potassium	23.36	1	2	3	4	1412012-BLK1	NA	1,000.00
		19.66				63.36	NA	
		5	6	7	8			
Magnesium	0.25	1	2	3	4	1412012-BLK1	NA	250.00
		1.43				0.59	NA	
		5	6	7	8			
Manganese	-0.13	1	2	3	4	1412012-BLK1	NA	5.00
		-0.12				-0.43	NA	
		5	6	7	8			
Sodium	4.42	1	2	3	4	1412012-BLK1	NA	1,000.00
		4.66				69.13	NA	
		5	6	7	8			

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C141006

Analytical Sequence: 1412031 Total Recoverable Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1412012-BLK1	NA	
Zinc	-1.84	-2.62				-2.82	NA	20.00
		5	6	7	8			

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.8 Analysis Name: ICPMS Tot. Rec. Metals

Instrument: ICPMS-PE DRC-II Work Order: Nu C141006

Analytical Sequence: 1412033 Total Recoverable Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Vanadium	0.23	1	2	3	4	NA	1412012-BLK2	3.00
		0.13				NA	0.00	
		5	6	7	8			
Chromium	0.13	1	2	3	4	NA	1412012-BLK2	2.00
		0.25				NA	0.48	
		5	6	7	8			
Cobalt	0.01	1	2	3	4	NA	1412012-BLK2	0.20
		0.01				NA	0.01	
		5	6	7	8			
Nickel	0.02	1	2	3	4	NA	1412012-BLK2	1.00
		0.02				NA	0.00	
		5	6	7	8			
Copper	0.00	1	2	3	4	NA	1412012-BLK2	1.00
		0.04				NA	-0.01	
		5	6	7	8			
Arsenic	-0.05	1	2	3	4	NA	1412012-BLK2	2.00
		-0.08				NA	-0.19	
		5	6	7	8			
Selenium	0.00	1	2	3	4	NA	1412012-BLK2	2.00
		-0.02				NA	-0.22	
		5	6	7	8			
Molybdenum	0.23	1	2	3	4	NA	1412012-BLK2	1.00
		0.18				NA	0.76	
		5	6	7	8			

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Intial and Continuing Calibration Blanks

Analytical Method: 200.8 Analysis Name: ICPMS Tot. Rec. Metals

Instrument: ICPMS-PE DRC-II Work Order: Nu C141006

Analytical Sequence: 1412033 Total Recoverable Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Silver	0.02	1	2	3	4	NA	1412012-BLK2	1.00
		0.02				NA	0.02	
		5	6	7	8			
Cadmium	0.01	1	2	3	4	NA	1412012-BLK2	0.20
		0.01				NA	0.01	
		5	6	7	8			
Antimony	0.09	1	2	3	4	NA	1412012-BLK2	1.00
		0.15				NA	-0.02	
		5	6	7	8			
Barium	0.01	1	2	3	4	NA	1412012-BLK2	10.00
		0.00				NA	0.10	
		5	6	7	8			
Thallium	0.01	1	2	3	4	NA	1412012-BLK2	1.00
		0.11				NA	-0.05	
		5	6	7	8			
Lead	0.00	1	2	3	4	NA	1412012-BLK2	0.20
		0.01				NA	0.00	
		5	6	7	8			

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1412023 Work Order: C141006 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Aluminum	12500	12740	101.9	1			2			3		
				12500	12790	102.3						
				4			5			6		
				7			8			9		
Beryllium	500	511.1	102.2	1			2			3		
				500	518.0	103.6						
				4			5			6		
				7			8			9		
Calcium	12500	12580	100.6	1			2			3		
				12500	12740	101.9						
				4			5			6		
				7			8			9		
Iron	12500	12650	101.2	1			2			3		
				12500	13140	105.1						
				4			5			6		
				7			8			9		
Magnesium	12500	12810	102.5	1			2			3		
				12500	12930	103.4						
				4			5			6		
				7			8			9		
Manganese	1000	1036	103.6	1			2			3		
				1000	1047	104.7						
				4			5			6		
				7			8			9		

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1412023 Work Order: C141006 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Potassium	25000	25530	102.1		1			2			3	
				25000	25600	102.4						
					4			5			6	
					7			8			9	
Sodium	12500	12830	102.6		1			2			3	
				12500	12800	102.4						
					4			5			6	
					7			8			9	
Zinc	2500	2578	103.1		1			2			3	
				2500	2609	104.4						
					4			5			6	
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 200.8 Analysis Name: ICPMS Diss. Metals

Sequence: 1412025 Work Order: C141006 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Antimony	50.0	49.6	99.2	1			2			3		
				50.0	49.3	98.6						
				4			5			6		
				7			8			9		
Arsenic	50.0	49.6	99.2	1			2			3		
				50.0	49.9	99.8						
				4			5			6		
				7			8			9		
Barium	50.0	48.3	96.6	1			2			3		
				50.0	49.6	99.2						
				4			5			6		
				7			8			9		
Cadmium	50.0	49.6	99.2	1			2			3		
				50.0	49.6	99.2						
				4			5			6		
				7			8			9		
Chromium	50.0	49.3	98.6	1			2			3		
				50.0	51.1	102.2						
				4			5			6		
				7			8			9		
Cobalt	50.0	48.9	97.8	1			2			3		
				50.0	48.1	96.2						
				4			5			6		
				7			8			9		

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Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 200.8 Analysis Name: ICPMS Diss. Metals

Sequence: 1412025 Work Order: C141006 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Copper	50.0	49.3	98.6		1			2			3	
				50.0	48.3	96.6						
					4			5			6	
					7			8			9	
Lead	50.0	49.1	98.2		1			2			3	
				50.0	49.8	99.6						
					4			5			6	
					7			8			9	
Molybdenum	50.0	49.3	98.6		1			2			3	
				50.0	49.8	99.6						
					4			5			6	
					7			8			9	
Nickel	50.0	48.7	97.4		1			2			3	
				50.0	48.7	97.4						
					4			5			6	
					7			8			9	
Selenium	50.0	51.3	102.6		1			2			3	
				50.0	48.7	97.4						
					4			5			6	
					7			8			9	
Silver	50.0	50.0	100.0		1			2			3	
				50.0	50.1	100.2						
					4			5			6	
					7			8			9	

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Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 200.8 Analysis Name: ICPMS Diss. Metals

Sequence: 1412025 Work Order: C141006 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
				1			2			3		
	50.0	49.9	99.8	50.0	50.2	100.4						
Thallium				4			5			6		
				7			8			9		
				1			2			3		
	50.0	47.9	95.8	50.0	48.9	97.8						
Vanadium				4			5			6		
				7			8			9		

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

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Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1412031 Work Order: C141006 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
				1			2			3		
				12500	12730	101.8						
Aluminum	12500	12770	102.2	4			5			6		
				7			8			9		
				1			2			3		
				500	506.1	101.2						
Beryllium	500	499.7	99.9	4			5			6		
				7			8			9		
				1			2			3		
				12500	12640	101.1						
Calcium	12500	12800	102.4	4			5			6		
				7			8			9		
				1			2			3		
				12500	12470	99.8						
Iron	12500	12940	103.5	4			5			6		
				7			8			9		
				1			2			3		
				12500	12840	102.7						
Magnesium	12500	12850	102.8	4			5			6		
				7			8			9		
				1			2			3		
				1000	1030	103.0						
Manganese	1000	1021	102.1	4			5			6		
				7			8			9		

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Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1412031 Work Order: C141006 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
				1			2			3		
	25000	25320	101.3	25000	25270	101.1						
Potassium				4			5			6		
				7			8			9		
				1			2			3		
	12500	12650	101.2	12500	12720	101.8						
Sodium				4			5			6		
				7			8			9		
				1			2			3		
	2500	2502	100.1	2500	2547	101.9						
Zinc				4			5			6		
				7			8			9		

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

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Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 200.8 Analysis Name: ICPMS Tot. Rec. Metals

Sequence: 1412033 Work Order: C141006 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Antimony	50.0	51.30	102.6	1			2			3		
				50.0	50.84	101.7						
				4			5			6		
				7			8			9		
Arsenic	50.0	52.17	104.3	1			2			3		
				50.0	52.10	104.2						
				4			5			6		
				7			8			9		
Barium	50.0	50.42	100.8	1			2			3		
				50.0	50.13	100.3						
				4			5			6		
				7			8			9		
Cadmium	50.0	51.87	103.7	1			2			3		
				50.0	51.15	102.3						
				4			5			6		
				7			8			9		
Chromium	50.0	49.71	99.4	1			2			3		
				50.0	52.28	104.6						
				4			5			6		
				7			8			9		
Cobalt	50.0	50.50	101.0	1			2			3		
				50.0	51.52	103.0						
				4			5			6		
				7			8			9		

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Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 200.8 Analysis Name: ICPMS Tot. Rec. Metals

Sequence: 1412033 Work Order: C141006 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Copper	50.0	50.68	101.4		1			2			3	
				50.0	52.08	104.2						
					4			5			6	
					7			8			9	
Lead	50.0	50.55	101.1		1			2			3	
				50.0	52.16	104.3						
					4			5			6	
					7			8			9	
Molybdenum	50.0	51.90	103.8		1			2			3	
				50.0	52.83	105.7						
					4			5			6	
					7			8			9	
Nickel	50.0	50.06	100.1		1			2			3	
				50.0	49.78	99.6						
					4			5			6	
					7			8			9	
Selenium	50.0	51.26	102.5		1			2			3	
				50.0	53.79	107.6						
					4			5			6	
					7			8			9	
Silver	50.0	51.70	103.4		1			2			3	
				50.0	51.58	103.2						
					4			5			6	
					7			8			9	

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Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 200.8 Analysis Name: ICPMS Tot. Rec. Metals

Sequence: 1412033 Work Order: C141006 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Thallium	50.0	51.11	102.2	1			2			3		
				50.0	52.07	104.1						
				4			5			6		
				7			8			9		
Vanadium	50.0	49.31	98.6	1			2			3		
				50.0	49.69	99.4						
				4			5			6		
				7			8			9		

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

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TDF #: A-048

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPMS-PE DRC-II

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1412025	Analysis: ICPMS Diss. Metals					
Antimony	IFA1	0.1	ug/L			1.00
	IFB1	0.0	ug/L			1.00
Arsenic	IFA1	0.0	ug/L			2.00
	IFB1	18.9	ug/L	20	95	2.00
Barium	IFA1	0.1	ug/L			10.0
	IFB1	0.0	ug/L			10.0
Cadmium	IFA1	0.1	ug/L			0.200
	IFB1	20.0	ug/L	20	100	0.200
Chromium	IFA1	0.2	ug/L			2.00
	IFB1	19.9	ug/L	20	99	2.00
Cobalt	IFA1	0.0	ug/L			0.200
	IFB1	18.9	ug/L	20	95	0.200
Copper	IFA1	0.6	ug/L			1.00
	IFB1	19.1	ug/L	20	96	1.00
Lead	IFA1	0.0	ug/L			0.200
	IFB1	0.0	ug/L			0.200
Molybdenum	IFA1	195.0	ug/L	200	98	1.00
	IFB1	191.4	ug/L	200	96	1.00
Nickel	IFA1	-0.1	ug/L			1.00
	IFB1	18.7	ug/L	20	94	1.00
Selenium	IFA1	-0.1	ug/L			2.00
	IFB1	-0.2	ug/L			2.00
Silver	IFA1	0.0	ug/L			1.00
	IFB1	19.6	ug/L	20	98	1.00
Thallium	IFA1	-0.1	ug/L			1.00
	IFB1	-0.1	ug/L			1.00
Vanadium	IFA1	-0.3	ug/L			3.00
	IFB1	-0.4	ug/L			3.00

*Criteria = 80-120%R of True Value or +/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPMS-PE DRC-II

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1412033 Analysis: ICPMS Tot. Rec. Metals						
Antimony	IFA1	0.0	ug/L			1.00
	IFB1	0.0	ug/L			1.00
Arsenic	IFA1	-0.1	ug/L			2.00
	IFB1	20.3	ug/L	20	102	2.00
Barium	IFA1	0.1	ug/L			10.0
	IFB1	0.0	ug/L			10.0
Cadmium	IFA1	0.1	ug/L			0.200
	IFB1	20.6	ug/L	20	103	0.200
Chromium	IFA1	0.4	ug/L			2.00
	IFB1	20.6	ug/L	20	103	2.00
Cobalt	IFA1	0.0	ug/L			0.200
	IFB1	20.0	ug/L	20	100	0.200
Copper	IFA1	0.6	ug/L			1.00
	IFB1	19.6	ug/L	20	98	1.00
Lead	IFA1	0.0	ug/L			0.200
	IFB1	0.0	ug/L			0.200
Molybdenum	IFA1	195.9	ug/L	200	98	1.00
	IFB1	198.0	ug/L	200	99	1.00
Nickel	IFA1	-0.2	ug/L			1.00
	IFB1	19.2	ug/L	20	96	1.00
Selenium	IFA1	-0.1	ug/L			2.00
	IFB1	0.0	ug/L			2.00
Silver	IFA1	0.0	ug/L			1.00
	IFB1	19.5	ug/L	20	98	1.00
Thallium	IFA1	0.0	ug/L			1.00
	IFB1	0.0	ug/L			1.00
Vanadium	IFA1	0.1	ug/L			3.00
	IFB1	-0.2	ug/L			3.00

*Criteria = 80-120%R of True Value or +/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1412023 Analysis: ICPOE Diss. Metals						
Aluminum	IFA1	60,959.4	ug/L	60,000	102	50.0
	IFB1	60,367.6	ug/L	60,000	101	50.0
Beryllium	IFA1	-0.6	ug/L			5.00
	IFB1	95.5	ug/L	100	96	5.00
Calcium	IFA1	307,033.7	ug/L	300,000	102	250
	IFB1	303,051.0	ug/L	300,000	101	250
Iron	IFA1	237,123.8	ug/L	250,000	95	250
	IFB1	235,541.0	ug/L	250,000	94	250
Magnesium	IFA1	145,901.0	ug/L	150,000	97	250
	IFB1	144,129.7	ug/L	150,000	96	250
Manganese	IFA1	-0.3	ug/L			5.00
	IFB1	197.6	ug/L	200	99	5.00
Potassium	IFA1	-87.8	ug/L			1000
	IFB1	20,942.3	ug/L	20,000	105	1000
Sodium	IFA1	51,674.3	ug/L	50,000	103	1000
	IFB1	50,876.6	ug/L	50,000	102	1000
Zinc	IFA1	-2.4	ug/L			20.0
	IFB1	282.4	ug/L	300	94	20.0

*Criteria = 80-120%R of True Value or +/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8
ICP Interference Check Sample
ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1412031 Analysis: ICPOE Tot. Rec. Metals						
Aluminum	IFA1	57,571.5	ug/L	60,000	96	50.0
	IFB1	58,196.1	ug/L	60,000	97	50.0
Beryllium	IFA1	-0.9	ug/L			5.00
	IFB1	92.5	ug/L	100	93	5.00
Calcium	IFA1	294,591.2	ug/L	300,000	98	250
	IFB1	295,559.6	ug/L	300,000	99	250
Iron	IFA1	230,658.5	ug/L	250,000	92	250
	IFB1	229,058.3	ug/L	250,000	92	250
Magnesium	IFA1	139,007.3	ug/L	150,000	93	250
	IFB1	141,277.7	ug/L	150,000	94	250
Manganese	IFA1	-0.7	ug/L			5.00
	IFB1	192.8	ug/L	200	96	5.00
Potassium	IFA1	-87.2	ug/L			1000
	IFB1	20,161.3	ug/L	20,000	101	1000
Sodium	IFA1	48,807.5	ug/L	50,000	98	1000
	IFB1	49,569.6	ug/L	50,000	99	1000
Zinc	IFA1	1.5	ug/L			20.0
	IFB1	270.5	ug/L	300	90	20.0

*Criteria = 80-120%R of True Value or +/- PQL
See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8
Detection Limit (PQL) Standard
ICPMS-PE DRC-II

Metals (Dissolved) by EPA 200/7000 Series Methods
Sequence: 1412025

Analyte	True	Found	%R	Units
Antimony	1.00	1.05	105	ug/L
Arsenic	2.00	2.05	103	ug/L
Barium	10.0	9.23	92	ug/L
Cadmium	0.200	0.232	116	ug/L
Chromium	2.00	1.82	91	ug/L
Cobalt	0.200	0.181	91	ug/L
Copper	1.00	0.954	95	ug/L
Lead	0.200	0.190	95	ug/L
Molybdenum	1.00	1.00	100	ug/L
Nickel	1.00	0.931	93	ug/L
Selenium	2.00	1.58	79	ug/L
Silver	1.00	0.934	93	ug/L
Thallium	1.00	0.887	89	ug/L
Vanadium	2.00	1.76	88	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%. No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw, Inc. - ESAT Region 8
Detection Limit (PQL) Standard
ICPOE - PE Optima

Metals (Dissolved) by EPA 200/7000 Series Methods
Sequence: 1412023

Analyte	True	Found	%R	Units
Aluminum	100	97.81	98	ug/L
Beryllium	5.00	5.008	100	ug/L
Calcium	250	245.3	98	ug/L
Iron	100	105.1	105	ug/L
Magnesium	1000	1014	101	ug/L
Manganese	10.0	11.00	110	ug/L
Potassium	1000	1064	106	ug/L
Sodium	1000	1052	105	ug/L
Zinc	50.0	55.14	110	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%. No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw, Inc. - ESAT Region 8

Detection Limit (PQL) Standard

ICPMS-PE DRC-II

Metals (Total Recov) by EPA 200/7000 Series Methods

Sequence: 1412033

Analyte	True	Found	%R	Units
Antimony	1.00	1.016	102	ug/L
Arsenic	2.00	1.875	94	ug/L
Barium	10.0	9.568	96	ug/L
Cadmium	0.200	0.1976	99	ug/L
Chromium	2.00	2.128	106	ug/L
Cobalt	0.200	0.2209	110	ug/L
Copper	1.00	1.036	104	ug/L
Lead	0.200	0.1901	95	ug/L
Molybdenum	1.00	1.063	106	ug/L
Nickel	1.00	1.064	106	ug/L
Selenium	2.00	1.776	89	ug/L
Silver	1.00	0.9307	93	ug/L
Thallium	1.00	0.9757	98	ug/L
Vanadium	2.00	2.117	106	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%. No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw, Inc. - ESAT Region 8
Detection Limit (PQL) Standard
ICPOE - PE Optima

Metals (Total Recov) by EPA 200/7000 Series Methods
Sequence: 1412031

Analyte	True	Found	%R	Units
Aluminum	100	100.0	100	ug/L
Beryllium	5.00	4.952	99	ug/L
Calcium	250	240.8	96	ug/L
Iron	100	102.7	103	ug/L
Magnesium	1000	1024	102	ug/L
Manganese	10.0	10.47	105	ug/L
Potassium	1000	1038	104	ug/L
Sodium	1000	1038	104	ug/L
Zinc	50.0	52.85	106	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%. No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.7 Dissolved Sequence ID#: 1412023

Instrument ID #: ICPOE - PE Optima Water LSR #: A-048

Analysis ID	Sample Name	Analysis Date	Analysis Time
1412023-ICV1	Initial Cal Check	12/03/14	11:24
1412023-SCV1	Secondary Cal Check	12/03/14	11:28
1412023-ICB1	Initial Cal Blank	12/03/14	11:31
1412023-CRL1	Instrument RL Check	12/03/14	11:34
1412023-IFA1	Interference Check A	12/03/14	11:36
1412023-IFB1	Interference Check B	12/03/14	11:40
1412020-BLK1	Blank	12/03/14	11:44
1412020-BS1	Blank Spike	12/03/14	11:47
C141006-02	AC2EFF	12/03/14	11:50
1412020-DUP1	Duplicate	12/03/14	11:54
1412023-SRD1	Serial Dilution	12/03/14	11:58
1412020-MS1	Matrix Spike	12/03/14	12:02
C141006-04	FDB	12/03/14	12:06
C141006-06	RDEFF	12/03/14	12:10
1412023-CCV1	Calibration Check	12/03/14	12:17
1412023-CCB1	Calibration Blank	12/03/14	12:20

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.8 Dissolved Sequence ID#: 1412025

Instrument ID #: ICPMS-PE DRC-II Water LSR #: A-048

Analysis ID	Sample Name	Analysis Date	Analysis Time
1412025-ICV1	Initial Cal Check	12/03/14	12:58
1412025-SCV1	Secondary Cal Check	12/03/14	13:01
1412025-ICB1	Initial Cal Blank	12/03/14	13:04
1412025-CRL1	Instrument RL Check	12/03/14	13:07
1412025-IFA1	Interference Check A	12/03/14	13:11
1412025-IFB1	Interference Check B	12/03/14	13:14
1412021-BLK1	Blank	12/03/14	13:17
1412021-BS1	Blank Spike	12/03/14	13:21
C141006-02	AC2EFF	12/03/14	13:24
1412021-DUP1	Duplicate	12/03/14	13:27
1412025-SRD1	Serial Dilution	12/03/14	13:30
1412021-MS1	Matrix Spike	12/03/14	13:33
C141006-04	FDB	12/03/14	13:36
C141006-06	RDEFF	12/03/14	13:39
1412025-CCV1	Calibration Check	12/03/14	13:52
1412025-CCB1	Calibration Blank	12/03/14	13:56

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.7 Total Recoverable Sequence ID#: 1412031

Instrument ID #: ICPOE - PE Optima Water LSR #: A-048

Analysis ID	Sample Name	Analysis Date	Analysis Time
1412031-ICV1	Initial Cal Check	12/04/14	10:17
1412031-SCV1	Secondary Cal Check	12/04/14	10:20
1412031-ICB1	Initial Cal Blank	12/04/14	10:23
1412031-CRL1	Instrument RL Check	12/04/14	10:26
1412031-IFA1	Interference Check A	12/04/14	10:29
1412031-IFB1	Interference Check B	12/04/14	10:33
1412012-BLK1	Blank	12/04/14	10:37
1412012-SRM1	Reference	12/04/14	10:40
C141006-01	AC2EFF	12/04/14	10:43
1412012-DUP1	Duplicate	12/04/14	10:47
1412031-SRD1	Serial Dilution	12/04/14	10:51
1412012-MS1	Matrix Spike	12/04/14	10:54
C141006-03	FDB	12/04/14	10:58
C141006-05	RDEFF	12/04/14	11:02
1412031-CCV1	Calibration Check	12/04/14	11:09
1412031-CCB1	Calibration Blank	12/04/14	11:12

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.8 Total Recoverable Sequence ID#: 1412033

Instrument ID #: ICPMS-PE DRC-II Water LSR #: A-048

Analysis ID	Sample Name	Analysis Date	Analysis Time
1412033-ICV1	Initial Cal Check	12/04/14	11:20
1412033-SCV1	Secondary Cal Check	12/04/14	11:24
1412033-ICB1	Initial Cal Blank	12/04/14	11:27
1412033-CRL1	Instrument RL Check	12/04/14	11:30
1412033-IFA1	Interference Check A	12/04/14	11:34
1412033-IFB1	Interference Check B	12/04/14	11:37
1412012-BLK2	Blank	12/04/14	11:40
C141006-01	AC2EFF	12/04/14	11:43
1412012-DUP2	Duplicate	12/04/14	11:46
1412033-SRD1	Serial Dilution	12/04/14	11:49
1412012-SRM2	Reference	12/04/14	11:53
1412012-MS2	Matrix Spike	12/04/14	11:56
C141006-03	FDB	12/04/14	11:59
C141006-05	RDEFF	12/04/14	12:02
1412033-CCV1	Calibration Check	12/04/14	12:08
1412033-CCB1	Calibration Blank	12/04/14	12:11

TechLaw

ESAT Region 8

Perkin Elmer ELAN DRC-II ICP-MS

2014 MDLs and PQLs
Contract: EP-W-06-33

2014	Dissolved MDL *u* g/L	Tot Rec. MDL *u* g/L	Practical MDL *u* g/L	PQL H20 ug/L	PQL Soil ug/Kg
Ag 107	0.02	0.05	0.50	1.0	100.0
Al 27	1.43	3.44	5.00	20.0	2000.0
As 75	0.32	0.32	0.50	2.0	200.0
Ba 135	0.04	0.06	5.00	10.0	1000.0
Be 9	0.09	0.08	0.10	0.2	20.0
Cd 111	0.03	0.01	0.10	0.2	20.0
Co 59	0.01	0.01	0.10	0.2	20.0
Cr 52	0.13	0.23	1.00	2.0	200.0
Cu 65	0.09	0.03	0.50	1.0	100.0
Mn 55	0.25	0.14	0.25	0.5	50.0
Mo 98	0.84	0.02	1.00	1.0	100.0
Ni 60	0.04	0.05	0.50	1.0	100.0
Pb 208	0.01	0.02	0.10	0.2	20.0
Sb 121	0.02	0.05	0.50	1.0	100.0
Se 82	0.25	0.42	1.00	2.0	200.0
Tl 205	0.01	0.01	0.50	1.0	100.0
Th 232	0.01	0.05	0.50	1.0	100.0
U 238	0.01	0.01	0.10	0.2	20.0
V 51	0.49	0.77	2.00	3.0	300.0
Zn 66	0.16	0.37	2.00	5.0	500.0

ICP-MS * MDL determined: January 2014

Last Updated: January 2014

TechLaw
Quality & Integrity

ESAT Region 8

Perkin Elmer Optima 4300 ICP-OE

2014 MDLs and PQLs
Contract: EP-W-06-33

2014		Dissolved MDL u g/L	Tot Rec. MDL u g/L	Practical MDL u g/L	PQL H20 u g/L	PQL Soil mg/Kg	Linear Range mg/L
Ag	Silver	0.863	0.833	2.0	10	1.0	5.0
Al	Aluminum	17.3	16.00	20	50	5.0	100
As	Arsenic	6.44	17.6	60	100	10	20
B	Boron	7.83	7.64	50	250	25	100
Ba	Barium	0.163	0.297	2.0	5.0	0.5	20
Be	Beryllium	0.075	0.069	2.0	5.0	0.5	10
Ca	Calcium	13.4	14	100	250	25	1000
Cd	Cadmium	0.174	0.19	2.0	5.0	0.5	20
Co	Cobalt	0.378	0.908	2.0	5.0	0.5	20
Cr	Chromium	0.319	0.301	2.0	5.0	0.5	20
Cu	Copper	0.711	0.583	2.0	2.0	0.2	50
Fe	Iron	55.82	26.9	100	250	25	500
K	Potassium	68.1	177	250	1000	100	500
Mg	Magnesium	50.6	6.68	100	250	25	500
Mn	Manganese	0.171	0.219	2.0	5.0	0.5	40
Mo	Molybdenum	1.85	3.68	10	20	2.0	50
Na	Sodium	12.2	14.2	250	1000	100	500
Ni	Nickel	1.92	1.66	5.0	10	1.0	100
Pb	Lead	6.83	5.1	10	25	2.5	100
Sb	Antimony	14.9	7.2	50	100	10	20
Se	Selenium	15.1	16.9	60	100	10	20
SiO2	Silica	4.84	7.11	250	1000	100	100
Sr	Strontium	0.255	0.336	2.0	10	1.0	1.0
Ti	Titanium	0.278	0.397	5.0	20	2.0	10
Tl	Thallium	7.36	7.4	20	50	5.0	20
V	Vanadium	1.19	1.730	10	50	5.0	25
Zn	Zinc	0.91	2.4	10	20	2.0	200

ICP-OE * MDL determined: January 2014

Last Updated: January 2014

TechLaw, Inc.
Environmental Services Assistance Team
16194 W. 45th Drive, Golden, CO 80403
303-312-7720

Task Order: 02
TDF: A-048
LIMS: C141006
DCN #: EP8-2-1089
Contract: EP-W-13-028

Rico Argentine – Waters – OCT 2014

Sample Calculation for Hardness

Sample ID: C141006-05

Calcium (µg/L)			Ca Hardness, mg/L
234000	divide by 1000, then x 2.497	=	584.30

Magnesium (µg/L)			Mg Hardness, mg/L
23400	divide by 1000, then x 4.118	=	96.36

Calculated Hardness, mg/L	680.66

TechLaw, Inc.
Environmental Services Assistance Team
16194 W. 45th Drive, Golden, CO 80403
303-312-7720

Task Order: 02
TDF: A-048
LIMS: C141006
DCN #: EP8-2-1089
Contract: EP-W-13-028

Rico Argentine – Waters – OCT 2014

Sample Identification
Cross-Reference Information

EPA Sample ID	ESAT LIMS ID
AC2EFF	C141006-01
AC2EFF	C141006-02
FDB	C141006-03
FDB	C141006-04
RDEFF	C141006-05
RDEFF	C141006-06

USEPA
DateShipped:
CarrierName:
AirbillNo:

CHAIN OF CUSTODY RECORD
Rico Argentine St. Louis Tunne/CO
Contact Name: Elliott Petri
Contact Phone: 719-216-2754

No: 8-100714-210859-0003
Cooler #:
Lab: ESAT
Lab Phone: 303-312-7798

Lab #	Sample #	Location	Analyses	Matrix	Collected	Numb Cont	Container	Preservative	MS/MSD
	AC2EFF	Vertic Flow - Outfall	Total Metals	Water	10/7/2014	1	500 mL poly	HNO3 pH<2	
	AC2EFF	Vertic Flow - Outfall	Dissolved Metals	Water	10/7/2014	1	500 mL poly	HNO3 pH<2	
	FDB	Flow Distrobution Box - Influent	Total Metals	Water	10/7/2014	1	500 mL poly	HNO3 pH<2	
	FDB	Flow Distrobution Box - Influent	Dissolved Metals	Water	10/7/2014	1	500 mL poly	HNO3 pH<2	
	RDEFF	Horizontal Wetland - Outfall Rock Drain	Total Metals	Water	10/7/2014	1	500 mL poly	HNO3 pH<2	
	RDEFF	Horizontal Wetland - Outfall Rock Drain	Dissolved Metals	Water	10/7/2014	1	500 mL poly	HNO3 pH<2	

Special Instructions: TDF A-048

Sample bottles have wrong date. Elliott sent email authorizing to change bottle date to match the ~~Chain~~ COC. 10/8/14

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time
		10/8/14		10/8/14							

C 14 1 00 6

ESAT Technical Direction Form

Contract No. EPW13028
EPA Region 8

Site ID: 08BU *Date Issued:* 6/3/2014 *Date*
TDF ID: A-048 *Date Updated:* *Closed By:*

Name: Rico Argentine 2014 Analytical Support Oct.

Details: The Contractor shall analyze approximately 10 surface water samples collected from the Rico Argentine St. Louis Tunnel Superfund site as indicated in the Analytical Information Section. The samples will be collected by Weston Solutions (Jan Christner) and sent to the ESAT R8 Lab during the week ending 6/6/14.

TO02/Subtask 02b: Inorganic Chemistry

The site RPM is Steve Way.

Analytical Information:

MATRIX

☑ Water ☐ Soils ☐ Vegetation ☐ Biota

WET CHEM

☐ TSS ☐ TDS ☐ DOC ☐ Alk ☐ Chloride ☐ Sulfate ☐ Fluoride ☐ Nitrate ☐ Nitrite
Other

METALS

☑ Dissolved ☑ Total Recoverable ☐ Total ☑ Hardness (Calc)

200.7: ☐ Ag ☑ Al ☐ As ☐ Ba ☒ Be ☐ B ☑ Ca ☐ Cd ☐ Co ☐ Cr ☐ Cu ☑ Fe ☑ K ☑ Mg
☒ Mn ☐ Mo ☑ Na ☐ Ni ☐ Pb ☐ Sb ☐ Se ☐ Sr ☐ Ti ☐ Tl ☐ V ☒ Zn ☐ SiO2

200.8: ☑ Ag ☐ Al ☑ As ☑ Ba ☑ Be ☑ Cd ☑ Co ☑ Cr ☑ Cu ☑ Mn ☑ Mo ☑ Ni ☑ Pb ☑ Sb
☑ Sc ☐ Th ☑ Tl ☐ U ☑ V ☑ Zn

7470/7471/747 ☐ Hg

12/03/14

FIBERS

☐ PLM ☐ TEM

Deliverables

ID	*Description*	*Due Date*	*Submission Date*
1	Provide final deliverable package to Task Monitor no later than 30 days after delivery of samples.		

6/3/14

TechLaw

Sample Receipt Form - TLF-51.00

Project: Rico Argentine Tunnel **TDF #:** A-048

Date Received: 10/8/14 **Time Received:** 8:45 **By:** ~~Janette~~ Jessica Boyles

1	Airbill/shipping documents present?	Drop Off	Yes	No
2	Custody seals on **shipping** containers present and intact? N/A	None	Yes	No
3	Custody seals on **sample** containers present and intact?	None	Yes	No
4	Chain of Custody (COC) present?		Yes	No
5	COC and sample container information agree?		Yes	No
6	Aqueous samples preserved correctly, if required?	N/A	Yes	No
7	Samples received within holding times for requested analyses?		Yes	No
8	Sufficient sample volume for requested analyses?		Yes	No
9	Sample containers intact and not leaking?		Yes	No
10	Sample containers appropriate for requested analyses?		Yes	No
11	Samples shipped on ice?		Yes	No
12	Cooler temperature(s) ≤ 6.0 °C?	N/A	Yes	No

Cooler #:	1	2	3	4	5
Temperature (°C):	5.9				

Comments and Additional Information:

Client notified of anomalies, if necessary?	N/A	Yes	No
Anomalies noted in case narrative and data qualified, if necessary ?	N/A	Yes	No

TechLaw, Inc.
Environmental Services Assistance Team
16194 W. 45th Drive, Golden, CO 80403
303-312-7721

Contract: EP-W-13-028

Certificates of Analysis

Valid through February 2015

Perkin Elmer Optima ICP-OE

Perkin Elmer ELAN ICP-MS

NIPPON NIC MA-3

Perkin Elmer FIMS 100

- Initial Calibration Verification (ICV) Standards
- Laboratory Check Standards (LCS)
- Matrix Spike Solutions
- Interference Check (ICSA / AB) Standards

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ACCREDITED Testing Laboratory Certificate 883.01

ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Silver in 5% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGAG1-1, CGAG1-2, and CGAG1-5
Lot Number:	**G2-AG03035**
Starting Material:	Ag shot
Starting Material Purity (%):	100.0000
Starting Material Lot No:	1641
Matrix:	5% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	1,002 ± 6 µg/mL -weighted mean-
Certified Density:	1.026 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods	**Characterization of CRM by one method**
Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$ X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$. w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance: $w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$; $w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$ **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{its} + u^2_{sts})^{½}$** $U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{its} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).	**Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:** X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{its} + u^2_{sts})^{½}$** $U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{its} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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ACCREDITED Testing Laboratory Certificate 883.01

ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Aluminum in 3% (v/v) HNO3**

Catalog Number:	CGAL1-1, CGAL1-2, and CGAL1-5
Lot Number:	**F2-AL04124**
Starting Material:	Al Shot
Starting Material Purity (%):	99.9991
Starting Material Lot No:	1757
Matrix:	3% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,005 ± 6 µg/mL -weighted mean-

Certified Density: 1.019 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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2.0 **DESCRIPTION OF CRM** **10000 µg/mL Aluminum in 7 % (v/v) HNO3**

Catalog Number:	CGAL10-1, CGAL10-2, and CGAL10-5
Lot Number:	**G2-AL04137**
Starting Material:	Al Shot
Starting Material Purity (%):	99.9993
Starting Material Lot No:	1757,1758
Matrix:	7 % (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 10,049 ± 42 µg/mL -no weighted mean-

Certified Density: 1.083 (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods	Characterization of CRM by one method
Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$ X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$. w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance: $w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$; $w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$ **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).	**Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:** X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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ACCREDITED Testing Laboratory Certificate 883.01 — ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Arsenic in 2% (v/v) HNO3**

Catalog Number:	CGAS1-1, CGAS1-2, and CGAS1-5
Lot Number:	**G2-AS02102**
Starting Material:	As Lump
Starting Material Purity (%):	99.9995
Starting Material Lot No:	1814
Matrix:	2% (v/v) HNO3

EXPIRES Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	1,001 ± 5 µg/mL -weighted mean-
Certified Density:	1.012 (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods

Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$

X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$.

w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2));$$

$$w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$$

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{1/2}$

$U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

Characterization of CRM by one method

Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:

X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{1/2}$

$U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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ACCREDITED Testing Laboratory Certificate 883.01

ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Gold HNO3 in 2% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGAUN1-1, CGAUN1-2, and CGAUN1-5
Lot Number:	**G2-AU04033**
Starting Material:	HAuCl4xH2O
Starting Material Purity (%):	99.9900
Starting Material Lot No:	1760
Matrix:	2% (v/v) HNO3

GOLD STD. 1000UG/ML
140113J

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,001 ± 6 µg/mL weighted mean

Certified Density: 1.010 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods	Characterization of CRM by one method
Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$ X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$. w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance: $w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$; $w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$ **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{1/2}$** $U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).	**Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:** X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{1/2}$** $U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Barium in 0.1%(v/v) HNO3**

Catalog Number:	CGBA1-1, CGBA1-2, and CGBA1-5
Lot Number:	**F2-BA02076**
Starting Material:	Ba(NO3)2
Starting Material Purity (%):	99.9998
Starting Material Lot No:	BAE42012A1
Matrix:	0.1%(v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 996 ± 5 µg/mL -No weighted mean-

Certified Density: 1.000 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\Sigma x_i}{n}$$

$$\text{Uncertainty } (\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

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- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Beryllium in 3% (v/v) HNO3**

Catalog Number:	CGBE1-1, CGBE1-2, and CGBE1-5
Lot Number:	**F2-BE02021**
Starting Material:	Be4O(OOCCH3)6
Starting Material Purity (%):	99.9999
Starting Material Lot No:	1772
Matrix:	3% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,003 ± 4 µg/mL - weighted mean

Certified Density: 1.022 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

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- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Boron in H2O**

Catalog Number:	CGB1-1, CGB1-2, and CGB1-5
Lot Number:	**F2-B02109**
Starting Material:	H3BO3
Starting Material Purity (%):	99.9995
Starting Material Lot No:	1631
Matrix:	H2O

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 999 ± 5 µg/mL -weighted mean-

Certified Density: 1.000 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

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· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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CERTIFICATE OF ANALYSIS

QC CALCIUM STD 1K PPM IN

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ACCREDITED Testing Laboratory Certificate 883.01

ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Calcium in 0.1% (v/v) HNO3**

Catalog Number:	CGCA1-1, CGCA1-2, and CGCA1-5
Lot Number:	**F2-CA04058**
Starting Material:	CaO
Starting Material Purity (%):	99.9974
Starting Material Lot No:	1635
Matrix:	0.1% (v/v) HNO3

EXPIRES Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,000 ± 5 µg/mL - weighted mean

Certified Density: 1.002 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$ ($\bar{x}$) = mean

x_i = individual results

n = number of measurements

Uncertainty (±) = $2 [\Sigma(s_i)^2]^{1/2}$ 2 = the coverage factor.

$[\Sigma(s_i)^2]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

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4.1	**Assay Method #1**	**1,001 ± 3 µg/mL** ICP Assay NIST SRM 3109a Lot Number: 050825
	Assay Method #2	**998 ± 3 µg/mL** EDTA NIST SRM 928 Lot Number: 928

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2.0 DESCRIPTION OF CRM **10000 µg/mL Calcium in 2% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGCA10-1, CGCA10-2, and CGCA10-5
Lot Number:	**G2-CA04084**
Starting Material:	CaO
Starting Material Purity (%):	99.9990
Starting Material Lot No:	Multiple Lots
Matrix:	2% (v/v) HNO3

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration: 9,972 ± 21 µg/mL -weighted mean-

Certified Density: 1.039 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods

Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$

X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$.

w_a **and** w_b = The weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2));$$

$$w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$$

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{1/2}$

$U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

Characterization of CRM by one method

Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:

X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{1/2}$

$U_{char\ a}$ is the square root of the sum of the squares of th errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighir and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standa uncertainty (transportation).

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Cadmium in 3% (v/v) HNO3**

Catalog Number:	CGCD1-1, CGCD1-2, and CGCD1-5
Lot Number:	**G2-CD02043**
Starting Material:	Cd shot
Starting Material Purity (%):	100.0000
Starting Material Lot No:	1714
Matrix:	3% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,004 ± 5 µg/mL -weighted mean-

Certified Density: 1.016 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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CERTIFICATE OF ANALYSIS

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Cobalt in 3% (v/v) HNO3**

Catalog Number:	CGCO1-1, CGCO1-2, and CGCO1-5
Lot Number:	**F2-CO02052**
Starting Material:	Co powder
Starting Material Purity (%):	99.9982
Starting Material Lot No:	1749
Matrix:	3% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,003 ± 5 µg/mL - weighted mean

Certified Density: 1.018 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Chromium (+3) in 2% (v/v) HNO3**

Catalog Number:	CGCR(3)1-1, CGCR(3)1-2, and CGCR(3)1-5
Lot Number:	**G2-CR03072**
Starting Material:	Cr pieces
Starting Material Purity (%):	99.9829
Starting Material Lot No:	1661
Matrix:	2% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 998 ± 4 µg/mL -No weighted mean-

Certified Density: 1.013 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods

Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$

X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$.

w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2));$$

$$w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$$

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$

$U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

Characterization of CRM by one method

Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:

X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$

$U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Copper in 3% (v/v) HNO3**

Catalog Number:	CGCU1-1, CGCU1-2, and CGCU1-5
Lot Number:	**G2-CU03007**
Starting Material:	Cu shot
Starting Material Purity (%):	100.0000
Starting Material Lot No:	1718
Matrix:	3% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,003 ± 5 µg/mL weighted mean

Certified Density: 1.016 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods	**Characterization of CRM by one method**
Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$ X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$. **w_a and w_b** = The weighting factors for each method calculated using the inverse square of the variance: $w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$; $w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$ **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).	**Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:** X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Iron in 2% (v/v) HNO3**

Catalog Number:	CGFE1-1, CGFE1-2, and CGFE1-5
Lot Number:	**G2-FE04030**
Starting Material:	Fe pieces
Starting Material Purity (%):	99.9977
Starting Material Lot No:	1762
Matrix:	2% (v/v) HNO3

EXPIRES Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 999 ± 4 µg/mL weighted mean

Certified Density: 1.010 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods

Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$

X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$.

w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2));$$

$$w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$$

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$

$U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

Characterization of CRM by one method

Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:

X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$

$U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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ACCREDITED Testing Laboratory Certificate 683.01 — ACCREDITED Reference Material Producer Certificate 883.02

2.0 DESCRIPTION OF CRM **10000 µg/mL Iron in 5 % (v/v) HNO3**

Catalog Number:	CGFE10-1, CGFE10-2, and CGFE10-5
Lot Number:	**G2-FE04029**
Starting Material:	Fe pieces
Starting Material Purity (%):	99.9977
Starting Material Lot No:	1762
Matrix:	5 % (v/v) HNO3

EXPIRES Feb. 01, 2015

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration:	9,977 ± 24 µg/mL -weighted mean-
Certified Density:	1.035 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods	Characterization of CRM by one method
Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$ X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$. **w_a and w_b** = The weighting factors for each method calculated using the inverse square of the variance: $w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$; $w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$ **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).	**Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:** X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Gadolinium in 7% (v/v) HNO3**

Catalog Number:	CGGD1-1, CGGD1-2, and CGGD1-5
Lot Number:	**G2-GD01049**
Starting Material:	Gd2O3
Starting Material Purity (%):	99.9987
Starting Material Lot No:	1675
Matrix:	7% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 999 ± 6 µg/mL -weighted mean-

Certified Density: 1.037 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Mercury in 5% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGHG1-1, CGHG1-2, and CGHG1-5
Lot Number:	**F2-HG02105**
Starting Material:	Hg metal
Starting Material Purity (%):	99.9997
Starting Material Lot No:	1780
Matrix:	5% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	1,000 ± 6 µg/mL -weighted mean-
Certified Density:	1.018 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\Sigma x_i}{n}$$

$$\text{Uncertainty } (\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1	**Assay Method #1**	**999 ± 4 µg/mL**
		ICP Assay NIST SRM 3133 Lot Number: 061204
	Assay Method #2	**1,001 ± 3 µg/mL**
		EDTA NIST SRM 928 Lot Number: 928

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Potassium in 0.1% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGK1-1, CGK1-2, and CGK1-5
Lot Number:	**G2-K03038**
Starting Material:	K2CO3
Starting Material Purity (%):	99.9985
Starting Material Lot No:	014K055
Matrix:	0.1% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	1,003 ± 4 µg/mL -weighted mean-
Certified Density:	1.000 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods

Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$

X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$.

w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2));$$

$$w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$$

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$

$U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

Characterization of CRM by one method

Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:

X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$

$U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 **DESCRIPTION OF CRM** **10000 µg/mL Potassium in 2% (v/v) HNO3**

Catalog Number:	CGK10-1, CGK10-2, and CGK10-5
Lot Number:	**F2-K03033**
Starting Material:	KNO3
Starting Material Purity (%):	99.9995
Starting Material Lot No:	1727
Matrix:	2% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 10,022 ± 60 µg/mL - weighted mean

Certified Density: 1.025 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
2 = the coverage factor
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Lithium in 0.1% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGLI1-1, CGLI1-2, and CGLI1-5
Lot Number:	**F2-LI02144**
Starting Material:	Li2CO3
Starting Material Purity (%):	99.9989
Starting Material Lot No:	1312
Matrix:	0.1% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,000 ± 6 µg/mL - weighted mean

Certified Density: 1.005 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\sum x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

($\bar{x}$) = mean

x_i = individual results

n = number of measurements

2 = the coverage factor.

$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Magnesium in 0.1% (v/v) HNO3**

Catalog Number:	CGMG1-1, CGMG1-2, and CGMG1-5
Lot Number:	**F2-MG03116**
Starting Material:	Mg chips
Starting Material Purity (%):	99.9998
Starting Material Lot No:	1484
Matrix:	0.1% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1003 ± 6 µg/mL -weighted mean-

Certified Density: 1.003 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements

Uncertainty $(\pm) = 2 [\Sigma(s_i)^2]^{½}$

2 = the coverage factor.
$[\Sigma(s_i)^2]^{½}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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2.0 **DESCRIPTION OF CRM** **10000 µg/mL Magnesium in 2% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGMG10-1, CGMG10-2, and CGMG10-5
Lot Number:	**G2-MG03120**
Starting Material:	Mg chips
Starting Material Purity (%):	99.9995
Starting Material Lot No:	1484
Matrix:	2% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	9,973 ± 20 µg/mL -weighted mean-
Certified Density:	1.053 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods

Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$

X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$.

w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2);$$

$$w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2)$$

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{1/2}$

$U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

Characterization of CRM by one method

Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:

X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{1/2}$

$U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Manganese in 3% (v/v) HNO3**

Catalog Number:	CGMN1-1, CGMN1-2, and CGMN1-5
Lot Number:	**G2-MN02106**
Starting Material:	Mn flake
Starting Material Purity (%):	99.9948
Starting Material Lot No:	1783
Matrix:	3% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,006 ± 5 µg/mL -weighted mean-

Certified Density: 1.020 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\Sigma x_i}{n}$$

$$\text{Uncertainty } (\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

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- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Molybdenum in H2O / tr. NH4OH**

EXPIRES Feb. 01, 2015

Catalog Number:	CGMO1-1, CGMO1-2, and CGMO1-5
Lot Number:	**G2-MO02053**
Starting Material:	(NH4)2MoO4
Starting Material Purity (%):	99.9965
Starting Material Lot No:	1734
Matrix:	H2O / tr. NH4OH

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	1,004 ± 6 µg/mL -No weighted mean-
Certified Density:	1.000 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods

Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$

X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$.

w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2);$$

$$w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2)$$

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$

$U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

Characterization of CRM by one method

Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:

X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$

$U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 DESCRIPTION OF CRM **1000 µg/mL Sodium in 0.1% (v/v) HNO3**

Catalog Number:	CGNA1-1, CGNA1-2, and CGNA1-5
Lot Number:	**G2-NA03108**
Starting Material:	Na2CO3
Starting Material Purity (%):	99.9992
Starting Material Lot No:	1628
Matrix:	0.1% (v/v) HNO3

EXPIRES Feb. 01, 2015

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Concentration:	996 ± 4 µg/mL -weighted mean-
Certified Density:	1.001 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods	Characterization of CRM by one method
Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$ X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$. w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance: $w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$; $w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$ **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).	**Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:** X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

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CERTIFICATE OF ANALYSIS

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ACCREDITED Testing Laboratory Certificate 883.01 — ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **10000 µg/mL Sodium in 2% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGNA10-1, CGNA10-2, and CGNA10-5
Lot Number:	**G2-NA03110**
Starting Material:	Na2CO3
Starting Material Purity (%):	99.9992
Starting Material Lot No:	1628
Matrix:	2% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	10,008 ± 17 µg/mL -weighted mean-
Certified Density:	1.033 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods	**Characterization of CRM by one method**
Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$ X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$. w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance: $w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$; $w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$ **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).	**Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:** X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Nickel in 2% (v/v) HNO3**

Catalog Number:	CGNI1-1, CGNI1-2, and CGNI1-5
Lot Number:	**G2-NI02086**
Starting Material:	Ni pieces
Starting Material Purity (%):	99.9998
Starting Material Lot No:	1559
Matrix:	2% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,002 ± 4 µg/mL -weighted mean-

Certified Density: 1.011 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

$$\text{Uncertainty } (\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1	**Assay Method #1**	**1,001 ± 3 µg/mL** ICP Assay NIST SRM 3136 Lot Number: 000612
	Assay Method #2	**1,002 ± 3 µg/mL** EDTA NIST SRM 928 Lot Number: 928

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CERTIFICATE OF ANALYSIS

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Lead in 0.5%(v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGPB1-1, CGPB1-2, and CGPB1-5
Lot Number:	**G2-PB03044**
Starting Material:	Pb(NO3)2
Starting Material Purity (%):	99.9998
Starting Material Lot No:	1717
Matrix:	0.5%(v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	1,000 ± 3 µg/mL -weighted mean-
Certified Density:	1.002 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods

Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$

X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$.

w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2));$$

$$w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$$

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{its} + u^2_{sts})^{½}$

$U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{its} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

Characterization of CRM by one method

Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:

X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{its} + u^2_{sts})^{½}$

$U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{its} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Antimony in 1% (v/v) HNO3 / 3% Tartaric Acid**

Catalog Number:	CGSB1-1, CGSB1-2 and CGSB1-5
Lot Number:	**F2-SB03010**
Starting Material:	Sb shot
Starting Material Purity (%):	99.9974
Starting Material Lot No:	1647
Matrix:	1% (v/v) HNO3 / 3% Tartaric Acid

EXPIRES Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,000 ± 5 µg/mL - weighted mean

Certified Density: 1.021 g/mL (measured at 20 ± 1°C)

The Certified Value is based upon the most precise method used to analyze this CRM. The following equations are used in the calculation of the certified value and the uncertainty.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Scandium in 7% (v/v) HNO3**

Catalog Number:	CGSC1-1, CGSC1-2, and CGSC1-5
Lot Number:	**G2-SC02111**
Starting Material:	Sc2O3
Starting Material Purity (%):	99.9917
Starting Material Lot No:	1745
Matrix:	7% (v/v) HNO3

EXPIRES
Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,002 ± 6 µg/mL -weighted mean-

Certified Density: 1.041 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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CERTIFICATE OF ANALYSIS

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Selenium(+4) in 2% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGSE(4)1-1, CGSE(4)1-2, and CGSE(4)1-5
Lot Number:	**E2-SE02033**
Starting Material:	Se shot
Starting Material Purity (%):	99.9996
Starting Material Lot No:	1616
Matrix:	2% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,001 ± 6 µg/mL - weighted mean

Certified Density: 1.011 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\Sigma x_i}{n}$$

$$\text{Uncertainty } (\pm) = \frac{2\,[(\Sigma s_i)^2]^{1/2}}{(n)^{1/2}}$$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
Σs_i = The summation of all significant estimated errors (Most common are the errors from instrumental measurement, weighing, dilution to volume and the fixed error reported on the NIST SRM certificate of analysis)

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

- "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)
- This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1	**Assay Method #1**	**1,002 ± 4 µg/mL** ICP Assay NIST SRM 3149 Lot Number: 100901
	Assay Method #2	**1,000 ± 3 µg/mL** Calculated NIST SRM Lot Number: See Sec. 4.2

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CERTIFICATE OF ANALYSIS

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Silica in 1% (v/v) HNO3 / tr. HF**

EXPIRES Feb. 01, 2015

Catalog Number:	CGSIO1-1, CGSIO1-2, and CGSIO1-5
Lot Number:	**F2-SI03020**
Starting Material:	SiO2
Starting Material Purity (%):	99.9993
Starting Material Lot No:	1551
Matrix:	1% (v/v) HNO3 / tr. HF

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,002 ± 5 µg/mL - weighted mean

Certified Density: 1.006 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

4.1 **Assay Method #1** **1,001 ± 3 µg/mL**
ICP Assay NIST SRM 3150 Lot Number: 071204

Assay Method #2 **1,002 ± 3 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Tin in tr. HNO3 / tr. HF**

EXPIRES Feb. 01, 2015

Catalog Number:	CGSN1-1, CGSN1-2, and CGSN1-5
Lot Number:	**G2-SN02058**
Starting Material:	Sn shot
Starting Material Purity (%):	99.9998
Starting Material Lot No:	1744
Matrix:	tr. HNO3 / tr. HF

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	1,000 ± 5 µg/mL -weighted mean-
Certified Density:	1.000 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods	**Characterization of CRM by one method**
Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$ X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$. w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance: $w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2)$; $w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2)$ **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).	**Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:** X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Strontium in 0.1% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGSR1-1, CGSR1-2, and CGSR1-5
Lot Number:	**F2-SR02036**
Starting Material:	SrCO3
Starting Material Purity (%):	99.9988
Starting Material Lot No:	1610
Matrix:	0.1% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,000 ± 5 µg/mL - weighted mean

Certified Density: 1.001 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

$(\bar{x})$ = mean

x_i = individual results

n = number of measurements

2 = the coverage factor.

$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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CERTIFICATE OF ANALYSIS

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **1000 µg/mL Thorium in 5% HNO3(v/v)**

EXPIRES Feb. 01, 2015

Catalog Number:	CGTH1-1, CGTH1-2, and CGTH1-5
Lot Number:	**G2-TH01094**
Starting Material:	Th(NO3)4x4H2O
Starting Material Purity (%):	99.9934
Starting Material Lot No:	1803
Matrix:	5% HNO3(v/v)

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	1,000 ± 4 µg/mL -weighted mean-
Certified Density:	1.026 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods	**Characterization of CRM by one method**
Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$ X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$. **w_a and w_b** = The weighting factors for each method calculated using the inverse square of the variance: $w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$; $w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$ **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).	**Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:** X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$. **CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$** $U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Titanium in 2% (v/v) HNO3 / tr. HF**

Catalog Number:	CGTI1-1, CGTI1-2, and CGTI1-5
Lot Number:	**F2-TI02094**
Starting Material:	Ti powder
Starting Material Purity (%):	99.9948
Starting Material Lot No:	1769
Matrix:	2% (v/v) HNO3 / tr. HF

EXPIRES Feb. 01, 2015

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,000 ± 6 µg/mL - weighted mean

Certified Density: 1.011 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Thallium in 0.7% (v/v) HNO3**

EXPIRES
Feb. 01, 2015

Catalog Number:	CGTL1-1, CGTL1-2, and CGTL1-5
Lot Number:	**F2-TL02003**
Starting Material:	TlNO3
Starting Material Purity (%):	99.9996
Starting Material Lot No:	1576
Matrix:	0.7% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 1,001 ± 5 µg/mL - weighted mean

Certified Density: 1.003 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements

Uncertainty $(\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$

2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Uranium in 2% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGU1-1, CGU1-2, and CGU1-5
Lot Number:	**F2-U01098**
Starting Material:	UO2(NO3)2.6H2O
Starting Material Purity (%):	99.9979
Starting Material Lot No:	1627
Matrix:	2% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	1,003 ± 6 µg/mL - weighted mean
Certified Density:	1.010 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\sum x_i}{n}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements

Uncertainty (±) = $2\,[\,\Sigma(s_i)^2\,]^{1/2}$

2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

Certified Abundance: The 235U in this standard is depleted. The Certified abundances in Atom % are as follows:

IV's Certified Abundance

Isotope	Atom%
Uranium 238U	99.6 ± 0.1
235U	0.42 ± 0.05

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Vanadium in 2% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGV1-1, CGV1-2, and CGV1-5
Lot Number:	**G2-V02081**
Starting Material:	V2O5
Starting Material Purity (%):	99.9991
Starting Material Lot No:	1782
Matrix:	2% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration:	1,000 ± 5 µg/mL -weighted mean-
Certified Density:	1.016 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods

Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$

X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$.

w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2));$$

$$w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$$

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$

$U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

Characterization of CRM by one method

Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:

X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{sts})^{½}$

$U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; k, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{lts} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 **DESCRIPTION OF CRM** **1000 µg/mL Zinc in 2% (v/v) HNO3**

EXPIRES Feb. 01, 2015

Catalog Number:	CGZN1-1, CGZN1-2, and CGZN1-5
Lot Number:	**F2-ZN02088**
Starting Material:	Zn shot
Starting Material Purity (%):	99.9999
Starting Material Lot No:	1689
Matrix:	2% (v/v) HNO3

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 998 ± 5 µg/mL -weighted mean-

Certified Density: 1.011 g/mL (measured at 20 ± 1°C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence interval using a coverage factor of k = 2.

Characterization of CRM by two independent methods

Certified Value, X_{CRM}, where two methods of characterization are used, is the weighted mean of the two results = $[(w_a)(X_a) + (w_b)(X_b)]$

X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

X_b is the mean of Assay Method B with standard uncertainty $U_{char\ b}$.

w_a and w_b = The weighting factors for each method calculated using the inverse square of the variance:

$$w_a = (1/U_{char\ a})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2));$$

$$w_b = (1/U_{char\ b})^2 / ((1/U_{char\ a})^2 + (1/U_{char\ b})^2))$$

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a\&b} + u^2_{bb} + u^2_{its} + u^2_{sts})^{1/2}$

$U_{char\ a\&b} = [(w_a)^2 (U_{char\ a})^2 + (w_b)^2 (U_{char\ b})^2]^{0.5}$; $U_{char\ a}$ and $U_{char\ b}$ are the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{its} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

Characterization of CRM by one method

Certified Value, X_{CRM}, where one method of characterization is used, is the mean of individual results:

X_a = Mean X_a is the mean of Assay Method A with standard uncertainty $U_{char\ a}$.

CRM Expanded Uncertainty (±) = $U_{CRM} = k\ (U^2_{char\ a} + u^2_{bb} + u^2_{its} + u^2_{sts})^{1/2}$

$U_{char\ a}$ is the square root of the sum of the squares of the errors from characterization which include instrumental measurement, density, NIST SRM uncertainty, weighing, and volume; **k**, coverage factor = 2 in all cases at Inorganic Ventures; u_{bb} = bottle to bottle homogeneity standard uncertainty; u_{its} = long term stability standard uncertainty (storage); u_{sts} = short term stability standard uncertainty (transportation).

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

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2.0 **DESCRIPTION OF CRM** **Stock Solution**

EXPIRES Feb. 01, 2015

Catalog No.: 2007ICS-1

Lot Number: **F2-MEB415153**

Matrix: 2% HNO3(v/v), 0.3% HF(v/v)

1,000 µg/mL ea:
Ti,

500 µg/mL ea:
B,

300 µg/mL ea:
Mo,

230 µg/mL ea:
Si

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Boron, B	500.0 ± 3.4 µg/mL	Molybdenum, Mo	300.0 ± 1.7 µg/mL	Silicon, Si	230.0 ± 1.1 µg/mL
Titanium, Ti	1,000 ± 7 µg/mL				

Certified Density: 1.014 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$ ($\bar{x}$) = mean

x_i = individual results

n = number of measurements

Uncertainty $(\pm) = 2 [\Sigma(s_i)^2]^{1/2}$ 2 = the coverage factor.

$[\Sigma(s_i)^2]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

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2007ICS-3, 7%HNO3
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2.0 **DESCRIPTION OF CRM** **Stock Solution**

Catalog No.: 2007ICS-3

Lot Number: **G2-MEB477055**

Matrix: 7% HNO3(v/v)

EXPIRES Feb. 01, 2015

20,000 µg/mL ea:
K,

1,000 µg/mL ea:
As, Pb, Tl,

500 µg/mL ea:
Se,

300 µg/mL ea:
Ag, Ba, Cd, Co, Cr3, Cu, Ni, V, Zn,

200 µg/mL ea:
Mn,

100 µg/mL ea:
Be

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Arsenic, As	1,000 ± 7 µg/mL	Barium, Ba	300.0 ± 2.0 µg/mL	Beryllium, Be	100.0 ± 0.6 µg/mL
Cadmium, Cd	300.0 ± 1.9 µg/mL	Chromium+3, Cr3	300.0 ± 1.9 µg/mL	Cobalt, Co	300.0 ± 2.0 µg/mL
Copper, Cu	300.0 ± 2.0 µg/mL	Lead, Pb	1,000 ± 7 µg/mL	Manganese, Mn	200.0 ± 1.3 µg/mL
Nickel, Ni	300.0 ± 2.0 µg/mL	Potassium, K	20,000.0 ± 90.0 µg/mL	Selenium, Se	500.0 ± 3.3 µg/mL
Silver, Ag	300.0 ± 1.9 µg/mL	Thallium, Tl	1,000 ± 7 µg/mL	Vanadium, V	300.0 ± 2.0 µg/mL
Zinc, Zn	300.0 ± 2.0 µg/mL				

Certified Density: 1.090 g/mL (measured at 20 ± 1° C)

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2.0 **DESCRIPTION OF CRM** **Stock Solution**

Catalog No.: 2007ICS-4

Lot Number: **F2-MEB423125**

Matrix: 3% HNO3(v/v)

EXPIRES
Feb. 01, 2015

15,000 µg/mL ea:
Ca,

12,500 µg/mL ea:
Fe,

7,500 µg/mL ea:
Mg,

3,000 µg/mL ea:
Al,

2,500 µg/mL ea:
Na

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Aluminum, Al	3,012 ± 19 µg/mL	Calcium, Ca	15,060.0 ± 100.0 µg/mL	Iron, Fe	12,550.0 ± 80.0 µg/mL
Magnesium, Mg	7,530.0 ± 50.0 µg/mL	Sodium, Na	2,510 ± 17 µg/mL		

Certified Density: 1.179 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements

Uncertainty $(\pm) = 2 [\Sigma(s_i)^2]^{1/2}$

2 = the coverage factor.
$[\Sigma(s_i)^2]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

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1.0 **INORGANIC VENTURES** is an ISO Guide 34 "General Requirements for the Competence of Reference Material Producers" and ISO 9001 registered manufacturer. Our manufacturing laboratory is accredited to ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories."

ACCREDITED Testing Laboratory Certificate 883.01

ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM**

	Stock Solution
Catalog No.:	6020ICS-0A
Lot Number:	**G2-MEB476152MCA**
Matrix:	1.4% HNO3(v/v)

EXPIRES
Feb. 01, 2015

10,000 µg/mL ea:
Chloride,

2,000 µg/mL ea:
C,

1,000 µg/mL ea:
Al, Ca, Fe, K, Mg, Na, P, S,

20 µg/mL ea:
Mo, Ti

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Aluminum, Al	1,002 ± 6 µg/mL	Calcium, Ca	1,002 ± 6 µg/mL	Carbon, C	2,004 ± 13 µg/mL
Chloride, Chloride	10,020.0 ± 50.0 µg/mL	Iron, Fe	1,002 ± 7 µg/mL	Magnesium, Mg	1,002 ± 4 µg/mL
Molybdenum, Mo	20.04 ± 0.14 µg/mL	Phosphorus, P	1,002 ± 7 µg/mL	Potassium, K	1,002 ± 4 µg/mL
Sodium, Na	1,002 ± 7 µg/mL	Sulfur, S	1,002 ± 5 µg/mL	Titanium, Ti	20.04 ± 0.13 µg/mL

Certified Density: 1.034 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements

$$\text{Uncertainty } (\pm) = 2\,[\,\Sigma(s_i)^2\,]^{1/2}$$

2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

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CERTIFICATE OF ANALYSIS

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM**

	Stock Solution
Catalog No.:	6020ICS-0B
Lot Number:	**G2-MEB463151**
Matrix:	3% HNO3(v/v)

EXPIRES
Feb. 01, 2015

2 µg/mL ea:
Ag, As, Cd, Co, Cr3, Cu, Mn, Ni, Zn

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Arsenic, As	2.000 ± 0.013 µg/mL	Cadmium, Cd	2.000 ± 0.013 µg/mL	Chromium+3, Cr3	2.000 ± 0.013 µg/mL
Cobalt, Co	2.000 ± 0.013 µg/mL	Copper, Cu	2.000 ± 0.013 µg/mL	Manganese, Mn	2.000 ± 0.013 µg/mL
Nickel, Ni	2.000 ± 0.013 µg/mL	Silver, Ag	2.000 ± 0.013 µg/mL	Zinc, Zn	2.000 ± 0.013 µg/mL

Certified Density: 1.012 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\Sigma x_i}{n}$$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements

$$\text{Uncertainty } (\pm) = 2\,[\,\Sigma(s_i)^2\,]^{\frac{1}{2}}$$

2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{\frac{1}{2}}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 **TRACEBILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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CERTIFICATE OF ANALYSIS

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ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Stock Solution**

Catalog No.: 6020SPK-W

Lot Number: **G2-MEB474101**

Matrix: 7% HNO3(v/v)

EXPIRES Feb. 01, 2015

100 µg/mL ea:
Fe,

50 µg/mL ea:
Ba, Zn,

20 µg/mL ea:
Co, Cr3, Cu, Mn, Ni, Sb, V,

10 µg/mL ea:
As, Pb,

5 µg/mL ea:
Ag, Be, Cd, Se, Tl

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Antimony, Sb	19.99 ± 0.14 µg/mL	Arsenic, As	9.99 ± 0.07 µg/mL	Barium, Ba	50.02 ± 0.33 µg/mL
Beryllium, Be	4.997 ± 0.029 µg/mL	Cadmium, Cd	4.995 ± 0.033 µg/mL	Chromium+3, Cr3	20.00 ± 0.13 µg/mL
Cobalt, Co	19.99 ± 0.13 µg/mL	Copper, Cu	19.99 ± 0.13 µg/mL	Iron, Fe	100.0 ± 0.6 µg/mL
Lead, Pb	10.00 ± 0.07 µg/mL	Manganese, Mn	19.99 ± 0.13 µg/mL	Nickel, Ni	20.02 ± 0.13 µg/mL
Selenium, Se	4.999 ± 0.034 µg/mL	Silver, Ag	5.002 ± 0.032 µg/mL	Thallium, Tl	5.000 ± 0.033 µg/mL
Vanadium, V	20.00 ± 0.13 µg/mL	Zinc, Zn	50.00 ± 0.33 µg/mL		

Certified Density: 1.035 g/mL (measured at 20 ± 1° C)

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CERTIFICATE OF ANALYSIS

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM**

	Stock Solution
Catalog No.:	6020SPK-W
Lot Number:	**G2-MEB474101**
Matrix:	7% HNO3(v/v)

EXPIRES
Feb. 01, 2015

100 µg/mL ea:
Fe,

50 µg/mL ea:
Ba, Zn,

20 µg/mL ea:
Co, Cr3, Cu, Mn, Ni, Sb, V,

10 µg/mL ea:
As, Pb,

5 µg/mL ea:
Ag, Be, Cd, Se, Tl

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Antimony, Sb	19.99 ± 0.14 µg/mL	Arsenic, As	9.99 ± 0.07 µg/mL	Barium, Ba	50.02 ± 0.33 µg/mL
Beryllium, Be	4.997 ± 0.029 µg/mL	Cadmium, Cd	4.995 ± 0.033 µg/mL	Chromium+3, Cr3	20.00 ± 0.13 µg/mL
Cobalt, Co	19.99 ± 0.13 µg/mL	Copper, Cu	19.99 ± 0.13 µg/mL	Iron, Fe	100.0 ± 0.6 µg/mL
Lead, Pb	10.00 ± 0.07 µg/mL	Manganese, Mn	19.99 ± 0.13 µg/mL	Nickel, Ni	20.02 ± 0.13 µg/mL
Selenium, Se	4.999 ± 0.034 µg/mL	Silver, Ag	5.002 ± 0.032 µg/mL	Thallium, Tl	5.000 ± 0.033 µg/mL
Vanadium, V	20.00 ± 0.13 µg/mL	Zinc, Zn	50.00 ± 0.33 µg/mL		

Certified Density: 1.035 g/mL (measured at 20 ± 1° C)

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CERTIFICATE OF ANALYSIS

QCP-QCS-1, 5% NITRIC
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ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Stock Second Source Solution**

EXPIRES Feb. 01, 2015

Catalog No.: QCP-QCS-1

Lot Number: **G2-MEB483134**

Matrix: 5% HNO3(v/v)

Second Source: Whenever possible, this solution was manufactured from a second set of concentrates in our manufacturing facility.

500 µg/mL ea:
K, P, Tl,

200 µg/mL ea:
As, Hg, Pb,

100 µg/mL ea:
Al, B, Ba, Be, Ca, Cd, Ce, Co, Cr3,
Cu, Fe, Li, Mg, Mn, Na, Ni, Se, Sr,
V, Zn,

25 µg/mL ea:
Ag

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Aluminum, Al	100.0 ± 0.6 µg/mL	Arsenic, As	199.9 ± 1.3 µg/mL	Barium, Ba	100.0 ± 0.7 µg/mL
Beryllium, Be	100.0 ± 0.7 µg/mL	Boron, B	100.0 ± 0.7 µg/mL	Cadmium, Cd	100.0 ± 0.7 µg/mL
Calcium, Ca	100.0 ± 0.6 µg/mL	Cerium, Ce	100.0 ± 0.7 µg/mL	Chromium+3, Cr3	100.0 ± 0.7 µg/mL
Cobalt, Co	100.0 ± 0.6 µg/mL	Copper, Cu	100.0 ± 0.7 µg/mL	Iron, Fe	100.0 ± 0.7 µg/mL
Lead, Pb	199.9 ± 1.5 µg/mL	Lithium, Li	100.0 ± 0.7 µg/mL	Magnesium, Mg	100.0 ± 0.7 µg/mL
Manganese, Mn	100.0 ± 0.6 µg/mL	Mercury, Hg	199.9 ± 1.4 µg/mL	Nickel, Ni	100.0 ± 0.7 µg/mL
Phosphorus, P	499.8 ± 3.4 µg/mL	Potassium, K	499.8 ± 3.3 µg/mL	Selenium, Se	100.0 ± 0.7 µg/mL
Silver, Ag	25.00 ± 0.16 µg/mL	Sodium, Na	100.0 ± 0.7 µg/mL	Strontium, Sr	100.0 ± 0.7 µg/mL
Thallium, Tl	499.8 ± 3.3 µg/mL	Vanadium, V	100.0 ± 0.5 µg/mL	Zinc, Zn	100.0 ± 0.6 µg/mL

Certified Density: 1.039 g/mL (measured at 20 ± 1° C)

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CERTIFICATE OF ANALYSIS

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ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Stock Second Source Solution**

EXPIRES Feb. 01, 2015

Catalog No.: QCP-QCS-2

Lot Number: **G2-MEB479071**

Matrix: 5% HNO3(v/v), tr. HF

Second Source: Whenever possible, this solution was manufactured from a second set of concentrates in our manufacturing facility.

500 µg/mL ea:
SiO2, Sn,

200 µg/mL ea:
Sb,

100 µg/mL ea:
Mo, Ti

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Antimony, Sb	200.0 ± 1.6 µg/mL	Molybdenum, Mo	100.0 ± 0.6 µg/mL	Silica, SiO2	500.0 ± 3.3 µg/mL
Tin, Sn	500.0 ± 3.2 µg/mL	Titanium, Ti	100.0 ± 0.7 µg/mL		

Certified Density: 1.027 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements

Uncertainty $(\pm) = 2 [\Sigma(s_i)^2]^{1/2}$

2 = the coverage factor.

$[\Sigma(s_i)^2]^{1/2}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

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CERTIFICATE OF ANALYSIS

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ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Stock Second Source Solution**

EXPIRES Feb. 01, 2015

Catalog No.: QCP-QCS-3

Lot Number: **G2-MEB479072**

Matrix: 7% HNO3(v/v)

Second Source: Whenever possible, this solution was manufactured from a second set of concentrates in our manufacturing facility.

50 µg/mL ea:
Se,

10 µg/mL ea:

Ag,	Al,	As,	Ba,	Be,	Ca,	Cd,	Co,	Cr3,
Cu,	Fe,	K,	Mg,	Mn,	Mo,	Na,	Ni,	Pb,
Sb,	Th,	Tl,	U,	V,	Zn			

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Aluminum, Al	10.01 ± 0.07 µg/mL	Antimony, Sb	10.01 ± 0.08 µg/mL	Arsenic, As	10.02 ± 0.07 µg/mL
Barium, Ba	10.01 ± 0.07 µg/mL	Beryllium, Be	10.00 ± 0.07 µg/mL	Cadmium, Cd	10.01 ± 0.07 µg/mL
Calcium, Ca	10.01 ± 0.06 µg/mL	Chromium+3, Cr3	10.00 ± 0.07 µg/mL	Cobalt, Co	10.01 ± 0.06 µg/mL
Copper, Cu	10.01 ± 0.07 µg/mL	Iron, Fe	10.02 ± 0.07 µg/mL	Lead, Pb	10.02 ± 0.08 µg/mL
Magnesium, Mg	10.01 ± 0.07 µg/mL	Manganese, Mn	10.02 ± 0.06 µg/mL	Molybdenum, Mo	10.02 ± 0.06 µg/mL
Nickel, Ni	10.01 ± 0.07 µg/mL	Potassium, K	10.01 ± 0.07 µg/mL	Selenium, Se	50.05 ± 0.37 µg/mL
Silver, Ag	10.02 ± 0.06 µg/mL	Sodium, Na	10.01 ± 0.07 µg/mL	Thallium, Tl	10.01 ± 0.06 µg/mL
Thorium, Th	10.01 ± 0.07 µg/mL	Uranium, U	10.02 ± 0.06 µg/mL	Vanadium, V	10.01 ± 0.05 µg/mL
Zinc, Zn	10.01 ± 0.06 µg/mL				

Certified Density: 1.036 g/mL (measured at 20 ± 1° C)

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CERTIFICATE OF ANALYSIS

QCP-QCS-4, 5PPM HG, 7% NT1
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ACCREDITED Testing Laboratory Certificate 863.01
ACCREDITED Reference Material Producer Certificate 863.02

2.0 **DESCRIPTION OF CRM** **Custom Second Source Solution**

EXPIRES Feb. 01, 2015

Catalog No.:	QCP-QCS-4
Lot Number:	**G2-MEB463148**
Matrix:	7% HNO3(v/v)

Second Source: Whenever possible, this solution was manufactured from a second set of concentrates in our manufacturing facility.

5 µg/mL ea:
Hg

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Mercury, Hg	5.001 ± 0.023 µg/mL				

Certified Density: 1.034 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\sum x_i}{n}$$

$$\text{Uncertainty } (\pm) = 2\,[\,\Sigma(s_i)^2\,]^{\frac{1}{2}}$$

($\bar{x}$) = mean
x_i = individual results
n = number of measurements
2 = the coverage factor.
$[\,\Sigma(s_i)^2\,]^{\frac{1}{2}}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

4.0 TRACEBILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS

· "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)

· This product is Traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRMs are available, the term 'in-house std.' is specified.

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a NIST SRM/RM. See section 4.2 for balance traceability.

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Stock Second Source Custom Solution**

Catalog No.: QCP-QCS-5

Lot Number: **G2-MEB474014**

Matrix: H2O

Second Source: Whenever possible, this solution was manufactured from a second set of concentrates in our manufacturing facility.

EXPIRES
Feb. 01, 2015

75 µg/mL ea:
Sulfate,

50 µg/mL ea:
Bromide,

25 µg/mL ea:
oPhosphate_as_P,

15 µg/mL ea:
Chloride, Nitrite_as_N,

10 µg/mL ea:
Fluoride, Nitrate_as_N

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Bromide, Bromide	50.00 ± 0.31 µg/mL	Chloride, Chloride	15.00 ± 0.09 µg/mL	Fluoride, Fluoride	10.00 ± 0.05 µg/mL
Nitrate_ as_ N, Nitrate_as_N	10.00 ± 0.05 µg/mL	Nitrite_ as_ N, Nitrite_as_N	15.00 ± 0.07 µg/mL	o-Phosphate as P, oPhosphate_as_P	25.00 ± 0.20 µg/mL
Sulfate, Sulfate	75.0 ± 0.4 µg/mL				

Certified Density: 0.999 g/mL (measured at 20 ± 1° C)

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CERTIFICATE OF ANALYSIS

WW-LFS-1, 5% NITRIC
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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM**

	Stock Solution
Catalog No.:	WW-LFS-1
Lot Number:	**F2-MEB419068**
Matrix:	5% HNO3(v/v)

EXPIRES
Feb. 01, 2015

1,000 µg/mL ea:
K,

600 µg/mL ea:
P,

300 µg/mL ea:
Fe, Na,

200 µg/mL ea:
Al, Ce, Mg, Se, Tl,

100 µg/mL ea:
Ca, Pb,

80 µg/mL ea:
As,

70 µg/mL ea:
Hg,

50 µg/mL ea:
Ni,

40 µg/mL ea:
Cr3,

30 µg/mL ea:
B, Cu, V,

20 µg/mL ea:
Ba, Be, Cd, Co, Li, Mn, Sr, Zn,

7.5 µg/mL ea:
Ag

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Aluminum, Al	200.0 ± 1.4 µg/mL	Arsenic, As	80.0 ± 0.5 µg/mL	Barium, Ba	20.00 ± 0.13 µg/mL
Beryllium, Be	20.00 ± 0.14 µg/mL	Boron, B	30.00 ± 0.20 µg/mL	Cadmium, Cd	20.01 ± 0.13 µg/mL
Calcium, Ca	100.0 ± 0.7 µg/mL	Cerium, Ce	200.0 ± 1.3 µg/mL	Chromium+3, Cr3	40.01 ± 0.28 µg/mL
Cobalt, Co	20.01 ± 0.13 µg/mL	Copper, Cu	30.00 ± 0.21 µg/mL	Iron, Fe	300.1 ± 2.0 µg/mL
Lead, Pb	100.0 ± 0.8 µg/mL	Lithium, Li	20.00 ± 0.14 µg/mL	Magnesium, Mg	200.0 ± 1.3 µg/mL

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CERTIFICATE OF ANALYSIS

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ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Stock Solution**

Catalog No.: WW-LFS-1

Lot Number: **F2-MEB419068**

Matrix: 5% HNO3(v/v)

EXPIRE
Feb. 01, 2015

1,000 µg/mL ea:
K,

600 µg/mL ea:
P,

300 µg/mL ea:
Fe, Na,

200 µg/mL ea:
Al, Ce, Mg, Se, Tl,

100 µg/mL ea:
Ca, Pb,

80 µg/mL ea:
As,

70 µg/mL ea:
Hg,

50 µg/mL ea:
Ni,

40 µg/mL ea:
Cr3,

30 µg/mL ea:
B, Cu, V,

20 µg/mL ea:
Ba, Be, Cd, Co, Li, Mn, Sr, Zn,

7.5 µg/mL ea:
Ag

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Aluminum, Al	200.0 ± 1.4 µg/mL	Arsenic, As	80.0 ± 0.5 µg/mL	Barium, Ba	20.00 ± 0.13 µg/mL
Beryllium, Be	20.00 ± 0.14 µg/mL	Boron, B	30.00 ± 0.20 µg/mL	Cadmium, Cd	20.01 ± 0.13 µg/mL
Calcium, Ca	100.0 ± 0.7 µg/mL	Cerium, Ce	200.0 ± 1.3 µg/mL	Chromium+3, Cr3	40.01 ± 0.28 µg/mL
Cobalt, Co	20.01 ± 0.13 µg/mL	Copper, Cu	30.00 ± 0.21 µg/mL	Iron, Fe	300.1 ± 2.0 µg/mL
Lead, Pb	100.0 ± 0.8 µg/mL	Lithium, Li	20.00 ± 0.14 µg/mL	Magnesium, Mg	200.0 ± 1.3 µg/mL

INORGANIC VENTURES™
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

WW-LFS-2, 5% NITRIC
140115AV

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
info@inorganicventures.com

1.0 **INORGANIC VENTURES** is an ISO Guide 34 "General Requirements for the Competence of Reference Material Producers" and ISO 9001 registered manufacturer. Our manufacturing laboratory is accredited to ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories."

ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Stock Solution**

EXPIRES Feb. 01, 2015

Catalog No.:	WW-LFS-2
Lot Number:	**F2-MEB420050**
Matrix:	5% HNO3(v/v), tr. HF

200 µg/mL ea:
SiO2,

80 µg/mL ea:
Sb,

70 µg/mL ea:
Sn,

40 µg/mL ea:
Mo,

20 µg/mL ea:
Ti

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Antimony, Sb	80.0 ± 0.6 µg/mL	Molybdenum, Mo	40.01 ± 0.22 µg/mL	Silica, SiO2	200.0 ± 0.9 µg/mL
Tin, Sn	70.0 ± 0.5 µg/mL	Titanium, Ti	20.01 ± 0.13 µg/mL		

Certified Density: 1.025 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$ ($\bar{x}$) = mean

x_i = individual results

n = number of measurements

Uncertainty (±) = $2 [\Sigma(s_i)^2]^{½}$ 2 = the coverage factor.

$[\Sigma(s_i)^2]^{½}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

INORGANIC VENTURES™
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

WW-LFS-2, 5% NITRIC
140115BF

tel: 800.669.6799 · 540.585.3030
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ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 **DESCRIPTION OF CRM** **Stock Solution**

Catalog No.: WW-LFS-2

Lot Number: **F2-MEB420050**

EXPIRES Feb. 01, 2015

Matrix: 5% HNO3(v/v), tr. HF

200 µg/mL ea:
SiO2,

80 µg/mL ea:
Sb,

70 µg/mL ea:
Sn,

40 µg/mL ea:
Mo,

20 µg/mL ea:
Ti

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE	ELEMENT	CERTIFIED VALUE
Antimony, Sb	80.0 ± 0.6 µg/mL	Molybdenum, Mo	40.01 ± 0.22 µg/mL	Silica, SiO2	200.0 ± 0.9 µg/mL
Tin, Sn	70.0 ± 0.5 µg/mL	Titanium, Ti	20.01 ± 0.13 µg/mL		

Certified Density: 1.025 g/mL (measured at 20 ± 1° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Certified Value $(\bar{x}) = \frac{\Sigma x_i}{n}$ ($\bar{x}$) = mean

x_i = individual results

n = number of measurements

Uncertainty (±) = $2 [\Sigma(s_i)^2]^{½}$ 2 = the coverage factor.

$[\Sigma(s_i)^2]^{½}$ = The square root of the sum of the squares of the most common errors (where 's' stands for the standard deviation) from instrumental measurement, density, NIST SRM uncertainty, weighing, dilution to volume, homogeneity, long term stability and short term stability.

PERKIN ELMER OPTIMA 4300DV ICP-OE

Project(s): Rio - Argenthe Oct 2014 Date: 12 / 03 / 2014

Work Order(s): C141006 TDF: A-048 Analyst: S. Van Overmeiren

Batch Preparation Information

Digest / Prep: TR / Total / (Diss.)

Matrix: (Water) / Soil / Other

Batch ID: 1412020

Data Storage

Data File: X:/Metals Data Files/ A048_1412020_141203

Standard Information

Calibration Std. # 1 = Reagent Blank Solution

SCV: *(LIMS ID: 4020403)*

Prepped: 10/20/14 By: SV

CRQL Stock: *(LIMS ID: 4020501)*

Prepped: 2-04-2014 By: SV

CRQL Daily *(LIMS ID: 4020502)*

Prepped: 12/03/14 By: SV

Calibration Std. # 2 = ESAT High, LIMS: 4020401

Prepped: 10/28/14 By: SV

ICV/CCV: 1:2 of 4020401 *(LIMS ID: 4020402)*

Prepped: 12/03/14 By: SV

ICSA: 4020404 **Prepped: 2-04-2014**

ICSAB: 4020405 Prepped: 2-04-2014

Spike Information

Dissolved Spikes

Sample ID: C141006-02

Sample ID:

Sample vol: 10 mL

QCS-3 : 100 uL

Exp: 2-1-2015 (LIMS ID: 4012234)

Salt Spike: 100 uL

Prepped 2-04-2014 *(LIMS ID: 4020314)*

Tot. / Tot. Rec. Spikes

Sample ID:

Sample Vol: 50 mL

WW-LFS1: 500 uL

Exp: 2-1-2015 *(LIMS ID: 4012235)*

WW-LFS2: 500 uL

Exp: 2-1-2015 *(LIMS ID: 4012236)*

Comments / Maintenance

Replace Nebulizer? Y / (N) New pump tubing? Y / (N) Replace torch or injector? Y / (N)

Analytes Reported:

Ag, (Al), As, Ba, (Be), B, (Ca), Cd, Co, Cr, Cu, (Fe), (K), (Mg),

(Mn), Mo, (Na), Ni, Pb, Sb, Se, SiO2, Sr, Ti, Tl, V, (Zn)

Sequence ID: 1412023

Lims Entry (Date / Init): 12/03/14 SV

TLF-06.02	SOP: QAQ-04.01	Eff. Date: 11/11/2013

ESAT Region 8

ICP-OE Data Review Form

Analyst / Bench Review – Level I

LIMS: C141006	**TDF:** A-048
Matrix: Water	**Analysis:** Dissolved metals

Method / Instrument QC Parameters				Analytical Batch / Sample Parameters	
☒ Yes ☐ No	ICV 95-105%	☒ Yes ☐ No	SCV 90-110%	☒ Yes ☐ No	Mth. Blk. (MB) / Prep. BLK (PB) ≤ ± PQL
☒ Yes ☐ No	ICB ≤ ± PQL	☒ Yes ☐ No	CRDL 70-130%	☒ Yes ☐ No	Blk. Spike (BS) 85-115% / SRM In Control
☒ Yes ☐ No	ICSA Spiked Analytes 80% - 120%			☒ Yes ☐ No	Laboratory Duplicate Analyzed
☒ Yes ☐ No	ICSA Non-Spiked Analytes ≤ ± PQL			☒ Yes ☐ No	MS Analyzed Every 10% of Samples 70-130%
☒ Yes ☐ No	ICSAB Spiked Analytes 80-120%			☒ Yes ☐ No	Serial Dilution Analyzed
☒ Yes ☐ No	CCBs ≤ ± PQL	☒ Yes ☐ No	CCVs 90-110%	☒ Yes ☐ No	Internal Standards 80-120%

Other data quality issues identified ☐ Yes ☒ No

Describe any anomaly or deficiency not indicated above in the space provided

LIMS Electronic Data Transfer			
☒ Yes ☐ No	The instrument data file is uploaded to the X: drive	☒ Yes ☐ No	Instrument data are uploaded into the LIMS
☒ Yes ☐ No	All samples and QC data are present in LIMS	☒ Yes ☐ No	The analyte list for the sequence is complete
Analyst:		Date:	12/03/14

Peer Review of Analytical Analysis – Level II

Method / Instrument QC Parameters				Analytical Batch / Sample Parameters	
☒ Yes ☐ No	ICV 95-105%	☒ Yes ☐ No	SCV 90-110%	☒ Yes ☐ No	Mth. Blk. (MB) / Prep. BLK (PB) ≤ ± PQL
☒ Yes ☐ No	ICB ≤ ± PQL	☒ Yes ☐ No	CRDL 70-130%	☒ Yes ☐ No	Blk. Spike (BS) 85-115% / SRM In Control
☒ Yes ☐ No	ICSA Spiked Analytes 80-120%			☒ Yes ☐ No	Laboratory Duplicate Analyzed
☒ Yes ☐ No	ICSA Non-Spiked Analytes ≤ ± PQL			☒ Yes ☐ No	MS Analyzed Every 10% of Samples 70-130%
☒ Yes ☐ No	ICSAB Spiked Analytes 80-120%			☒ Yes ☐ No	Serial Dilution Analyzed
☒ Yes ☐ No	CCBs ≤ ± PQL	☒ Yes ☐ No	CCVs 90-110%	☒ Yes ☐ No	Internal Standards 80-120%

Other data quality issues identified ☐ Yes ☒ No

Describe any anomaly or deficiency not indicated above in the space provided

LIMS Electronic Data Transfer			
☒ Yes ☐ No	The instrument data file is uploaded to the X: drive	☒ Yes ☐ No	Instrument data are uploaded into the LIMS
☒ Yes ☐ No	All samples and QC data are present in LIMS	☒ Yes ☐ No	The analyte list for the sequence is complete
Peer Reviewer:		Date:	12/4/2014

PREPARATION BENCH SHEET

1412020

TechLaw, Inc. - ESAT Region 8

Printed: 12/3/2014 10:23:42AM

Matrix: Water

Date Prepared: 12/03/14 10:22 By: SV **Prepared using: METALS - No Lab Prep Reqd**

Lab Number	Analysis	EPA Tag ID	Initial (mL)	Final (mL)	Spike1 ID	ul Spike1	Spike2 ID	ul Spike2	Source ID	QC Code	Extraction Comments
C141006-02 A	DM-Hardness - Calculated	8-B	50	50						AC2EFF	8-B
C141006-04 A	DM-Hardness - Calculated	8-B	50	50						FDB	8-B
C141006-06 A	DM-Hardness - Calculated	8-B	50	50						RDEFF	8-B
C141006-02 A	ICPOE Diss. Metals	8-B	50	50						AC2EFF	8-B
C141006-04 A	ICPOE Diss. Metals	8-B	50	50						FDB	8-B
C141006-06 A	ICPOE Diss. Metals	8-B	50	50						RDEFF	8-B
1412020-BLK1	QC		50	50						Blank	
1412020-BS1	QC		10	10	4020315	100				LCS	
1412020-DUP1	QC		50	50					C141006-02	Duplicate	
1412020-MS1	QC		10	10	4020315	100			C141006-02	Matrix Spike	

12/03/14

Preparation Reviewed By Date

ANALYSIS SEQUENCE

1412023 12/03/14

Instrument: ICPOE - PE Optima Sequence Date: 12/03/14 00:00 Printed: 12/3/2014 12:38:48PM

Lab Number	Dilut. Factor	Analysis	STD ID	Sample/Std Name	EPA Tag ID	Source Sple	Comments
1412023-ICV1		QC	4020402	Initial Cal Check		-	
1412023-SCV1		QC	4020403	Secondary Cal Check		-	
1412023-ICB1		QC		Initial Cal Blank		-	
1412023-CRL1		QC	4020502	Instrument RL Check		-	
1412023-IFA1		QC	4020404	Interference Check A		-	
1412023-IFB1		QC	4020405	Interference Check B		-	
1412020-BLK1		QC		Blank		-	
1412020-BS1		QC		LCS		-	
C141006-02 A		DM-Hardness - Calculated		AC2EFF	8-B		
C141006-02 A		ICPOE Diss. Metals		AC2EFF	8-B		
1412020-DUP1		QC		Duplicate		C141006-02	
1412023-SRD1		QC		Serial Dilution		C141006-02	
1412020-MS1		QC		Matrix Spike		C141006-02	
C141006-04 A		DM-Hardness - Calculated		FDB	8-B		
C141006-04 A		ICPOE Diss. Metals		FDB	8-B		
C141006-06 A		DM-Hardness - Calculated		RDEFF	8-B		
C141006-06 A		ICPOE Diss. Metals		RDEFF	8-B		
1412023-CCV1		QC	4020402	Calibration Check		-	
1412023-CCB1		QC		Calibration Blank		-	

Analytical Sequence

Method : ESAT_2013_1.0

12/03/14

Seq.	Loc.		Sample ID
1	1		Cal Blank
2	9		High Std
3	3	QC	SEQ-ICV
4	10	QC	SEQ-SCV
5	1	QC	SEQ-ICB
6	11	QC	SEQ-CRL
7	12	QC	SEQ-IFA
8	13	QC	SEQ-IFB
9	26		1412020-BLK1
10	27		1412020-BS1
11	28		C141006-02
12	29		1412020-DUP1
13	30		SEQ-SRD1 @5X
14	31		1412020-MS1
15	32		C141006-04
16	33		C141006-06
17	34		Blank
18	3	QC	SEQ-CCV
19	1	QC	SEQ-CCB

Sample Information Detail Report
Document Name: A-048_1412020_OED_141203

File Description
A-048 Rico-Argentine Oct 2014

Parameters Common to All Samples

Batch ID	1412020
Analyst Name	S.VanOvermeiren
Volume Units	mL
Weight Units	g

Parameters That Vary By Sample

Sample No	A/S Location	Sample ID	Remarks
1	26	1412020-BLK1	
2	27	1412020-BS1	
3	28	C141006-02	
4	29	1412020-DUP1	
5	30	SEQ-SRD1 @5X	
6	31	1412020-MS1	
7	32	C141006-04	
8	33	C141006-06	
9	34	Blank	

Sample No	Aliquot Volume	Diluted To Vol.	Matrix Check Sample
1			
2			Recovery 3 of 1
3			
4			Duplicate of 3
5	2	10	5X Dilution of 3
6			Recovery 3 of 3
7			
8			
9			

12/03/14

==========

Analysis Begun

Start Time: 12/3/2014 11:16:21 AM **Plasma On Time: 12/3/2014 7:26:01 AM**
Logged In Analyst: esat **Technique: ICP Continuous**
Spectrometer Model: Optima 4300 DV, S/N 077N3082602Autosampler Model: AS-93plus

Sample Information File: C:\pe\Administrator\Sample Information\2014\A-048 Rico-Arg\A-048_1412020_OED_141
Batch ID: 1412020
Results Data Set: A-048_1412020_141203
Results Library: C:\pe\Administrator\Results\Results.mdb

==========

Sequence No.: 1 **Autosampler Location: 1**
Sample ID: Cal Blank **Date Collected: 12/3/2014 11:16:21 AM**
Analyst: **Data Type: Original**
Initial Sample Wt: **Initial Sample Vol:**
Dilution: **Sample Prep Vol:**

Nebulizer Parameters: Cal Blank

Analyte	Back Pressure	Flow
All	247.0 kPa	0.80 L/min

Mean Data: Cal Blank

Analyte	Mean Corrected Intensity	Std.Dev.	RSD	Conc.	Calib Units
Sc Axial	2283713.1	12707.50	0.56%	100.0	%
Sc Radial	340351.9	776.29	0.23%	100.0	%
Ag 328.068†	-147.0	10.79	7.34%	[0.00]	ug/L
Al 396.153†	14.6	12.75	87.53%	[0.00]	ug/L
As 193.696†	-10.7	1.12	10.44%	[0.00]	ug/L
Ba 233.527†	-11.4	0.67	5.92%	[0.00]	ug/L
Be 313.107†	-941.4	18.27	1.94%	[0.00]	ug/L
B 249.677†	-119.3	0.99	0.83%	[0.00]	ug/L
Ca 317.933†	13.1	9.70	74.19%	[0.00]	ug/L
Cd 214.440†	-3.8	1.39	36.69%	[0.00]	ug/L
Co 228.616†	-21.6	2.03	9.39%	[0.00]	ug/L
Cr 267.716†	1.8	1.27	72.05%	[0.00]	ug/L
Cu 324.752†	2953.8	37.31	1.26%	[0.00]	ug/L
Fe 238.204†	6.2	0.81	12.96%	[0.00]	ug/L
K 766.490†	-28.5	17.75	62.33%	[0.00]	ug/L
Mg 285.213†	87.9	1.65	1.88%	[0.00]	ug/L
Mn 257.610†	48.0	4.48	9.34%	[0.00]	ug/L
Mo 202.031†	-4.4	1.92	44.17%	[0.00]	ug/L
Na 589.592†	166.1	1.79	1.08%	[0.00]	ug/L
Ni 231.604†	97.7	2.66	2.72%	[0.00]	ug/L
Pb 220.353†	-8.3	1.55	18.63%	[0.00]	ug/L
Sb 206.836†	10.0	0.41	4.07%	[0.00]	ug/L
Se 196.026†	1.4	2.90	201.23%	[0.00]	ug/L
SiO2 251.603†	212.5	8.48	3.99%	[0.00]	ug/L
Sr 421.552†	4352.7	6.25	0.14%	[0.00]	ug/L
Ti 334.940†	9.3	0.70	7.56%	[0.00]	ug/L
Tl 190.801†	-3.2	2.83	87.40%	[0.00]	ug/L
V 290.880†	1732.5	8.30	0.48%	[0.00]	ug/L
Zn 206.200†	-7.4	0.54	7.22%	[0.00]	ug/L

Sequence No.: 2
Sample ID: High Std
Analyst:
Initial Sample Wt:
Dilution:

Autosampler Location: 9
Date Collected: 12/3/2014 11:19:21 AM
Data Type: Original
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: High Std

Analyte	Back Pressure	Flow
All	247.0 kPa	0.80 L/min

Mean Data: High Std

Analyte	Mean Corrected Intensity	Std.Dev.	RSD	Conc.	Calib Units
Sc Axial	2246348.9	9181.62	0.41%	98.36	%
Sc Radial	338412.2	4637.38	1.37%	99.43	%
Ag 328.068†	27898.4	104.97	0.38%	[500]	ug/L
Al 396.153†	135209.0	3421.42	2.53%	[25000]	ug/L
As 193.696†	471.5	3.80	0.81%	[5000]	ug/L
Ba 233.527†	8158.2	83.21	1.02%	[1000]	ug/L
Be 313.107†	331374.8	428.49	0.13%	[1000]	ug/L
B 249.677†	76599.2	406.53	0.53%	[10000]	ug/L
Ca 317.933†	47534.9	866.13	1.82%	[25000]	ug/L
Cd 214.440†	2345.7	14.47	0.62%	[1000]	ug/L
Co 228.616†	3220.0	7.04	0.22%	[1000]	ug/L
Cr 267.716†	22899.6	200.80	0.88%	[5000]	ug/L
Cu 324.752†	349709.8	48.39	0.01%	[2000]	ug/L
Fe 238.204†	1393.4	14.50	1.04%	[25000]	ug/L
K 766.490†	106184.0	3078.49	2.90%	[50000]	ug/L
Mg 285.213†	121975.6	3221.94	2.64%	[25000]	ug/L
Mn 257.610†	218958.6	258.26	0.12%	[2000]	ug/L
Mo 202.031†	489.1	4.54	0.93%	[1000]	ug/L
Na 589.592†	185544.8	5203.67	2.80%	[25000]	ug/L
Ni 231.604†	11659.1	49.91	0.43%	[5000]	ug/L
Pb 220.353†	2279.9	3.96	0.17%	[5000]	ug/L
Sb 206.836†	1205.0	8.18	0.68%	[5000]	ug/L
Se 196.026†	401.0	1.23	0.31%	[5000]	ug/L
SiO2 251.603†	71704.6	277.26	0.39%	[20000]	ug/L
Sr 421.552†	3080085.4	4753.96	0.15%	[1000]	ug/L
Ti 334.940†	191875.0	593.38	0.31%	[1000]	ug/L
Tl 190.801†	1301.5	3.21	0.25%	[5000]	ug/L
V 290.880†	46493.7	266.10	0.57%	[2000]	ug/L
Zn 206.200†	3868.3	15.69	0.41%	[5000]	ug/L

Calibration Summary

Analyte	Stds.	Equation	Intercept	Slope	Curvature	Corr. Coef.	Reslope
Ag 328.068	1	Lin Thru 0	0.0	55.80	0.00000	1.000000	
Al 396.153	1	Lin, Calc Int	0.0	5.408	0.00000	1.000000	
As 193.696	1	Lin Thru 0	0.0	0.0943	0.00000	1.000000	
Ba 233.527	1	Lin Thru 0	0.0	8.158	0.00000	1.000000	
Be 313.107	1	Lin Thru 0	0.0	331.4	0.00000	1.000000	
B 249.677	1	Lin Thru 0	0.0	7.660	0.00000	1.000000	
Ca 317.933	1	Lin Thru 0	0.0	1.901	0.00000	1.000000	
Cd 214.440	1	Lin Thru 0	0.0	2.346	0.00000	1.000000	
Co 228.616	1	Lin Thru 0	0.0	3.220	0.00000	1.000000	
Cr 267.716	1	Lin Thru 0	0.0	4.580	0.00000	1.000000	
Cu 324.752	1	Lin Thru 0	0.0	174.9	0.00000	1.000000	
Fe 238.204	1	Lin, Calc Int	0.0	0.0557	0.00000	1.000000	
K 766.490	1	Lin Thru 0	0.0	2.124	0.00000	1.000000	
Mg 285.213	1	Lin, Calc Int	0.0	4.879	0.00000	1.000000	
Mn 257.610	1	Lin Thru 0	0.0	109.5	0.00000	1.000000	
Mo 202.031	1	Lin Thru 0	0.0	0.4891	0.00000	1.000000	
Na 589.592	1	Lin, Calc Int	0.0	7.422	0.00000	1.000000	
Ni 231.604	1	Lin Thru 0	0.0	2.332	0.00000	1.000000	
Pb 220.353	1	Lin Thru 0	0.0	0.4560	0.00000	1.000000	
Sb 206.836	1	Lin Thru 0	0.0	0.2410	0.00000	1.000000	

Se 196.026	1	Lin Thru 0	0.0	0.0802	0.00000	1.000000
SiO2 251.603	1	Lin, Calc Int	0.0	3.585	0.00000	1.000000
Sr 421.552	1	Lin, Calc Int	0.0	3080	0.00000	1.000000
Ti 334.940	1	Lin Thru 0	0.0	191.9	0.00000	1.000000
Tl 190.801	1	Lin Thru 0	0.0	0.2603	0.00000	1.000000
V 290.880	1	Lin Thru 0	0.0	23.25	0.00000	1.000000
Zn 206.200	1	Lin Thru 0	0.0	0.7737	0.00000	1.000000

Sequence No.: 3 **Autosampler Location: 3**
Sample ID: SEQ-ICV **Date Collected: 12/3/2014 11:22:35 AM**
Analyst: **Data Type: Original**
Initial Sample Wt: **Initial Sample Vol:**
Dilution: **Sample Prep Vol:**

Nebulizer Parameters: SEQ-ICV

Analyte	Back Pressure	Flow
All	248.0 kPa	0.80 L/min

Mean Data: SEQ-ICV

Analyte	Mean Corrected Intensity	Calib Conc.	Units	Std.Dev.	Sample Conc.	Units	Std.Dev.	RSD
Sc Axial	2275034.2	99.62	%	0.311				0.31%
Sc Radial	341568.2	100.4	%	0.93				0.93%
Ag 328.068†	14067.8	256.2	ug/L	0.65	256.2	ug/L	0.65	0.25%
QC value within limits for Ag 328.068 Recovery = 102.46%								
Al 396.153†	68931.9	12740	ug/L	282.1	12740	ug/L	282.1	2.21%
QC value within limits for Al 396.153 Recovery = 101.93%								
As 193.696†	240.1	2587	ug/L	36.7	2587	ug/L	36.7	1.42%
QC value within limits for As 193.696 Recovery = 103.46%								
Ba 233.527†	4155.9	506.6	ug/L	2.91	506.6	ug/L	2.91	0.58%
QC value within limits for Ba 233.527 Recovery = 101.31%								
Be 313.107†	169450.5	511.1	ug/L	1.29	511.1	ug/L	1.29	0.25%
QC value within limits for Be 313.107 Recovery = 102.23%								
B 249.677†	39067.4	5100	ug/L	5.0	5100	ug/L	5.0	0.10%
QC value within limits for B 249.677 Recovery = 102.00%								
Ca 317.933†	24037.4	12580	ug/L	262.0	12580	ug/L	262.0	2.08%
QC value within limits for Ca 317.933 Recovery = 100.64%								
Cd 214.440†	1201.8	511.8	ug/L	2.10	511.8	ug/L	2.10	0.41%
QC value within limits for Cd 214.440 Recovery = 102.36%								
Co 228.616†	1649.8	512.8	ug/L	4.94	512.8	ug/L	4.94	0.96%
QC value within limits for Co 228.616 Recovery = 102.56%								
Cr 267.716†	11676.8	2551	ug/L	9.8	2551	ug/L	9.8	0.38%
QC value within limits for Cr 267.716 Recovery = 102.02%								
Cu 324.752†	175149.4	1004	ug/L	1.7	1004	ug/L	1.7	0.17%
QC value within limits for Cu 324.752 Recovery = 100.40%								
Fe 238.204†	706.8	12650	ug/L	155.3	12650	ug/L	155.3	1.23%
QC value within limits for Fe 238.204 Recovery = 101.21%								
K 766.490†	54557.0	25530	ug/L	549.1	25530	ug/L	549.1	2.15%
QC value within limits for K 766.490 Recovery = 102.13%								
Mg 285.213†	62569.1	12810	ug/L	291.8	12810	ug/L	291.8	2.28%
QC value within limits for Mg 285.213 Recovery = 102.51%								
Mn 257.610†	113570.8	1036	ug/L	4.6	1036	ug/L	4.6	0.45%
QC value within limits for Mn 257.610 Recovery = 103.63%								
Mo 202.031†	247.2	503.2	ug/L	4.52	503.2	ug/L	4.52	0.90%
QC value within limits for Mo 202.031 Recovery = 100.65%								
Na 589.592†	96076.1	12830	ug/L	272.3	12830	ug/L	272.3	2.12%
QC value within limits for Na 589.592 Recovery = 102.65%								
Ni 231.604†	5982.0	2565	ug/L	5.0	2565	ug/L	5.0	0.20%
QC value within limits for Ni 231.604 Recovery = 102.62%								
Pb 220.353†	1173.2	2568	ug/L	13.1	2568	ug/L	13.1	0.51%
QC value within limits for Pb 220.353 Recovery = 102.71%								
Sb 206.836†	606.3	2480	ug/L	6.6	2480	ug/L	6.6	0.27%
QC value within limits for Sb 206.836 Recovery = 99.21%								
Se 196.026†	211.8	2645	ug/L	47.3	2645	ug/L	47.3	1.79%
QC value greater than the upper limit for Se 196.026 Recovery = 105.80%								
SiO2 251.603†	36322.8	10120	ug/L	8.0	10120	ug/L	8.0	0.08%
QC value within limits for SiO2 251.603 Recovery = 101.15%								
Sr 421.552†	1606459.2	520.3	ug/L	0.65	520.3	ug/L	0.65	0.13%
QC value within limits for Sr 421.552 Recovery = 104.06%								
Ti 334.940†	97288.1	507.0	ug/L	0.60	507.0	ug/L	0.60	0.12%
QC value within limits for Ti 334.940 Recovery = 101.41%								
Tl 190.801†	670.8	2580	ug/L	14.4	2580	ug/L	14.4	0.56%
QC value within limits for Tl 190.801 Recovery = 103.22%								
V 290.880†	23602.2	1014	ug/L	2.5	1014	ug/L	2.5	0.24%
QC value within limits for V 290.880 Recovery = 101.38%								

Zn 206.200†	1998.8	2578 ug/L	7.1	2578 ug/L	7.1	0.28%

QC value within limits for Zn 206.200 Recovery = 103.11%
QC Failed. Continue with analysis.

Sequence No.: 4 **Autosampler Location: 10**
Sample ID: SEQ-SCV **Date Collected: 12/3/2014 11:25:39 AM**
Analyst: **Data Type: Original**
Initial Sample Wt: **Initial Sample Vol:**
Dilution: **Sample Prep Vol:**

Nebulizer Parameters: SEQ-SCV

Analyte	Back Pressure	Flow
All	247.0 kPa	0.80 L/min

Mean Data: SEQ-SCV

Analyte	Mean Corrected Intensity	Calib Conc.	Calib Units	Std.Dev.	Sample Conc.	Sample Units	Std.Dev.	RSD
Sc Axial	2281747.0	99.91	%	0.314				0.31%
Sc Radial	341778.6	100.4	%	0.79				0.79%
Ag 328.068†	14259.5	259.2	ug/L	2.17	259.2	ug/L	2.17	0.84%
QC value within limits for Ag 328.068 Recovery = 103.66%								
Al 396.153†	5220.3	943.7	ug/L	22.73	943.7	ug/L	22.73	2.41%
QC value within limits for Al 396.153 Recovery = 94.37%								
As 193.696†	189.7	2032	ug/L	30.6	2032	ug/L	30.6	1.51%
QC value within limits for As 193.696 Recovery = 101.60%								
Ba 233.527†	8393.0	1027	ug/L	13.1	1027	ug/L	13.1	1.28%
QC value within limits for Ba 233.527 Recovery = 102.69%								
Be 313.107†	337196.7	1017	ug/L	1.8	1017	ug/L	1.8	0.18%
QC value within limits for Be 313.107 Recovery = 101.74%								
B 249.677†	7964.0	1040	ug/L	8.3	1040	ug/L	8.3	0.80%
QC value within limits for B 249.677 Recovery = 103.97%								
Ca 317.933†	1891.5	940.8	ug/L	6.28	940.8	ug/L	6.28	0.67%
QC value within limits for Ca 317.933 Recovery = 94.08%								
Cd 214.440†	2403.8	1025	ug/L	7.5	1025	ug/L	7.5	0.74%
QC value within limits for Cd 214.440 Recovery = 102.46%								
Co 228.616†	3332.0	1036	ug/L	7.5	1036	ug/L	7.5	0.73%
QC value within limits for Co 228.616 Recovery = 103.56%								
Cr 267.716†	4618.3	1009	ug/L	11.8	1009	ug/L	11.8	1.16%
QC value within limits for Cr 267.716 Recovery = 100.95%								
Cu 324.752†	176677.6	1012	ug/L	5.2	1012	ug/L	5.2	0.51%
QC value within limits for Cu 324.752 Recovery = 101.22%								
Fe 238.204†	55.2	975.8	ug/L	33.92	975.8	ug/L	33.92	3.48%
QC value within limits for Fe 238.204 Recovery = 97.58%								
K 766.490†	10801.3	4842	ug/L	94.0	4842	ug/L	94.0	1.94%
QC value within limits for K 766.490 Recovery = 96.84%								
Mg 285.213†	4854.8	985.6	ug/L	10.53	985.6	ug/L	10.53	1.07%
QC value within limits for Mg 285.213 Recovery = 98.56%								
Mn 257.610†	115111.9	1051	ug/L	8.4	1051	ug/L	8.4	0.80%
QC value within limits for Mn 257.610 Recovery = 105.06%								
Mo 202.031†	492.6	1007	ug/L	5.7	1007	ug/L	5.7	0.57%
QC value within limits for Mo 202.031 Recovery = 100.70%								
Na 589.592†	7782.3	965.1	ug/L	18.35	965.1	ug/L	18.35	1.90%
QC value within limits for Na 589.592 Recovery = 96.51%								
Ni 231.604†	2435.0	1046	ug/L	6.6	1046	ug/L	6.6	0.63%
QC value within limits for Ni 231.604 Recovery = 104.61%								
Pb 220.353†	938.3	2051	ug/L	5.9	2051	ug/L	5.9	0.29%
QC value within limits for Pb 220.353 Recovery = 102.53%								
Sb 206.836†	476.8	1972	ug/L	16.8	1972	ug/L	16.8	0.85%
QC value within limits for Sb 206.836 Recovery = 98.60%								
Se 196.026†	82.2	1027	ug/L	13.0	1027	ug/L	13.0	1.27%
QC value within limits for Se 196.026 Recovery = 102.66%								
SiO2 251.603†	18045.7	4977	ug/L	18.1	4977	ug/L	18.1	0.36%
QC value within limits for SiO2 251.603 Recovery = 99.54%								
Sr 421.552†	3212637.8	1042	ug/L	2.9	1042	ug/L	2.9	0.28%
QC value within limits for Sr 421.552 Recovery = 104.25%								
Ti 334.940†	195863.8	1021	ug/L	0.6	1021	ug/L	0.6	0.06%
QC value within limits for Ti 334.940 Recovery = 102.08%								
Tl 190.801†	1309.5	5037	ug/L	33.2	5037	ug/L	33.2	0.66%
QC value within limits for Tl 190.801 Recovery = 100.73%								
V 290.880†	23443.8	1010	ug/L	8.0	1010	ug/L	8.0	0.79%
QC value within limits for V 290.880 Recovery = 101.00%								

Zn 206.200†	790.3	1014 ug/L	12.5	1014 ug/L	12.5	1.23%

QC value within limits for Zn 206.200 Recovery = 101.37%

All analyte(s) passed QC.

Sequence No.: 5 **Autosampler Location: 1**
Sample ID: SEQ-ICB **Date Collected: 12/3/2014 11:28:52 AM**
Analyst: **Data Type: Original**
Initial Sample Wt: **Initial Sample Vol:**
Dilution: **Sample Prep Vol:**

Nebulizer Parameters: SEQ-ICB

Analyte	Back Pressure	Flow
All	249.0 kPa	0.80 L/min

Mean Data: SEQ-ICB

Analyte	Mean Corrected Intensity	Calib Conc.	Calib Units	Std.Dev.	Sample Conc.	Sample Units	Std.Dev.	RSD
Sc Axial	2321449.7	101.7	%	0.62				0.61%
Sc Radial	343665.5	101.0	%	0.35				0.34%
Ag 328.068†	17.2	0.3139	ug/L	0.23068	0.3139	ug/L	0.23068	73.50%
QC value within limits for Ag 328.068 Recovery = Not calculated								
Al 396.153†	-0.8	-0.3661	ug/L	3.48555	-0.3661	ug/L	3.48555	952.01%
QC value within limits for Al 396.153 Recovery = Not calculated								
As 193.696†	1.1	11.40	ug/L	29.176	11.40	ug/L	29.176	255.96%
QC value within limits for As 193.696 Recovery = Not calculated								
Ba 233.527†	0.7	0.0759	ug/L	0.02688	0.0759	ug/L	0.02688	35.43%
QC value within limits for Ba 233.527 Recovery = Not calculated								
Be 313.107†	187.4	0.5649	ug/L	0.04913	0.5649	ug/L	0.04913	8.70%
QC value within limits for Be 313.107 Recovery = Not calculated								
B 249.677†	115.0	15.01	ug/L	0.986	15.01	ug/L	0.986	6.57%
QC value within limits for B 249.677 Recovery = Not calculated								
Ca 317.933†	0.7	0.2290	ug/L	2.34525	0.2290	ug/L	2.34525	>999.9%
QC value within limits for Ca 317.933 Recovery = Not calculated								
Cd 214.440†	1.3	0.5610	ug/L	0.92842	0.5610	ug/L	0.92842	165.48%
QC value within limits for Cd 214.440 Recovery = Not calculated								
Co 228.616†	0.5	0.1515	ug/L	0.17800	0.1515	ug/L	0.17800	117.49%
QC value within limits for Co 228.616 Recovery = Not calculated								
Cr 267.716†	0.5	0.1108	ug/L	0.17883	0.1108	ug/L	0.17883	161.43%
QC value within limits for Cr 267.716 Recovery = Not calculated								
Cu 324.752†	-172.5	-0.9833	ug/L	0.12980	-0.9833	ug/L	0.12980	13.20%
QC value within limits for Cu 324.752 Recovery = Not calculated								
Fe 238.204†	0.3	5.803	ug/L	44.7133	5.803	ug/L	44.7133	770.55%
QC value within limits for Fe 238.204 Recovery = Not calculated								
K 766.490†	51.1	24.12	ug/L	14.774	24.12	ug/L	14.774	61.25%
QC value within limits for K 766.490 Recovery = Not calculated								
Mg 285.213†	-2.1	-0.4686	ug/L	0.27426	-0.4686	ug/L	0.27426	58.53%
QC value within limits for Mg 285.213 Recovery = Not calculated								
Mn 257.610†	13.3	0.1183	ug/L	0.03332	0.1183	ug/L	0.03332	28.16%
QC value within limits for Mn 257.610 Recovery = Not calculated								
Mo 202.031†	2.2	4.538	ug/L	6.0866	4.538	ug/L	6.0866	134.13%
QC value within limits for Mo 202.031 Recovery = Not calculated								
Na 589.592†	7.1	0.7292	ug/L	0.56437	0.7292	ug/L	0.56437	77.40%
QC value within limits for Na 589.592 Recovery = Not calculated								
Ni 231.604†	-5.0	-2.134	ug/L	2.1150	-2.134	ug/L	2.1150	99.13%
QC value within limits for Ni 231.604 Recovery = Not calculated								
Pb 220.353†	1.2	2.508	ug/L	11.9682	2.508	ug/L	11.9682	477.28%
QC value within limits for Pb 220.353 Recovery = Not calculated								
Sb 206.836†	-0.3	-1.108	ug/L	9.3172	-1.108	ug/L	9.3172	840.56%
QC value within limits for Sb 206.836 Recovery = Not calculated								
Se 196.026†	2.8	34.74	ug/L	32.173	34.74	ug/L	32.173	92.61%
QC value within limits for Se 196.026 Recovery = Not calculated								
SiO2 251.603†	-3.1	-0.8809	ug/L	1.91859	-0.8809	ug/L	1.91859	217.81%
QC value within limits for SiO2 251.603 Recovery = Not calculated								
Sr 421.552†	370.1	0.119	ug/L	0.0130	0.119	ug/L	0.0130	10.93%
QC value within limits for Sr 421.552 Recovery = Not calculated								
Ti 334.940†	65.1	0.339	ug/L	0.0285	0.339	ug/L	0.0285	8.41%
QC value within limits for Ti 334.940 Recovery = Not calculated								
Tl 190.801†	1.1	4.245	ug/L	11.3421	4.245	ug/L	11.3421	267.16%
QC value within limits for Tl 190.801 Recovery = Not calculated								
V 290.880†	-107.3	-4.601	ug/L	0.8510	-4.601	ug/L	0.8510	18.50%
QC value within limits for V 290.880 Recovery = Not calculated								

Zn 206.200†	0.8	1.013 ug/L	0.7908	1.013 ug/L	0.7908	78.07%

QC value within limits for Zn 206.200 Recovery = Not calculated

All analyte(s) passed QC.

Sequence No.: 6 **Autosampler Location: 11**
Sample ID: SEQ-CRL **Date Collected: 12/3/2014 11:31:53 AM**
Analyst: **Data Type: Original**
Initial Sample Wt: **Initial Sample Vol:**
Dilution: **Sample Prep Vol:**

Nebulizer Parameters: SEQ-CRL

Analyte	Back Pressure	Flow
All	249.0 kPa	0.80 L/min

Mean Data: SEQ-CRL

Analyte	Mean Corrected Intensity	Calib Conc.	Calib Units	Std.Dev.	Sample Conc.	Sample Units	Std.Dev.	RSD
Sc Axial	2237718.5	97.99	%	0.790				0.81%
Sc Radial	338937.7	99.58	%	0.838				0.84%
Ag 328.068†	575.8	10.42	ug/L	0.071	10.42	ug/L	0.071	0.68%
QC value within limits for Ag 328.068 Recovery = 104.19%								
Al 396.153†	529.4	97.81	ug/L	1.108	97.81	ug/L	1.108	1.13%
QC value within limits for Al 396.153 Recovery = 97.81%								
As 193.696†	4.1	45.00	ug/L	18.479	45.00	ug/L	18.479	41.07%
QC value within limits for As 193.696 Recovery = 89.99%								
Ba 233.527†	86.7	10.58	ug/L	0.318	10.58	ug/L	0.318	3.01%
QC value within limits for Ba 233.527 Recovery = 105.82%								
Be 313.107†	1661.5	5.008	ug/L	0.0252	5.008	ug/L	0.0252	0.50%
QC value within limits for Be 313.107 Recovery = 100.16%								
B 249.677†	2051.6	267.8	ug/L	0.94	267.8	ug/L	0.94	0.35%
QC value within limits for B 249.677 Recovery = 107.13%								
Ca 317.933†	469.5	245.3	ug/L	2.35	245.3	ug/L	2.35	0.96%
QC value within limits for Ca 317.933 Recovery = 98.13%								
Cd 214.440†	25.1	10.71	ug/L	0.342	10.71	ug/L	0.342	3.19%
QC value within limits for Cd 214.440 Recovery = 107.09%								
Co 228.616†	34.0	10.58	ug/L	0.515	10.58	ug/L	0.515	4.87%
QC value within limits for Co 228.616 Recovery = 105.80%								
Cr 267.716†	44.2	9.698	ug/L	0.5706	9.698	ug/L	0.5706	5.88%
QC value within limits for Cr 267.716 Recovery = 96.98%								
Cu 324.752†	1810.4	10.40	ug/L	0.152	10.40	ug/L	0.152	1.46%
QC value within limits for Cu 324.752 Recovery = 103.98%								
Fe 238.204†	5.9	105.1	ug/L	38.97	105.1	ug/L	38.97	37.08%
QC value within limits for Fe 238.204 Recovery = 105.09%								
K 766.490†	2267.5	1064	ug/L	31.1	1064	ug/L	31.1	2.92%
QC value within limits for K 766.490 Recovery = 106.41%								
Mg 285.213†	4947.0	1014	ug/L	10.1	1014	ug/L	10.1	1.00%
QC value within limits for Mg 285.213 Recovery = 101.36%								
Mn 257.610†	1208.5	11.00	ug/L	0.089	11.00	ug/L	0.089	0.81%
QC value within limits for Mn 257.610 Recovery = 109.97%								
Mo 202.031†	5.9	12.12	ug/L	3.686	12.12	ug/L	3.686	30.43%
QC value within limits for Mo 202.031 Recovery = 121.15%								
Na 589.592†	7825.4	1052	ug/L	18.9	1052	ug/L	18.9	1.79%
QC value within limits for Na 589.592 Recovery = 105.21%								
Ni 231.604†	26.6	11.41	ug/L	2.497	11.41	ug/L	2.497	21.88%
QC value within limits for Ni 231.604 Recovery = 114.12%								
Pb 220.353†	17.7	38.73	ug/L	5.296	38.73	ug/L	5.296	13.67%
QC value within limits for Pb 220.353 Recovery = 129.09%								
Sb 206.836†	11.2	46.21	ug/L	7.629	46.21	ug/L	7.629	16.51%
QC value within limits for Sb 206.836 Recovery = 92.42%								
Se 196.026†	7.0	87.76	ug/L	6.254	87.76	ug/L	6.254	7.13%
QC value within limits for Se 196.026 Recovery = 87.76%								
SiO2 251.603†	832.8	231.5	ug/L	1.59	231.5	ug/L	1.59	0.69%
QC value within limits for SiO2 251.603 Recovery = 92.59%								
Sr 421.552†	34065.8	11.04	ug/L	0.030	11.04	ug/L	0.030	0.28%
QC value within limits for Sr 421.552 Recovery = 110.42%								
Ti 334.940†	9972.1	51.97	ug/L	0.065	51.97	ug/L	0.065	0.12%
QC value within limits for Ti 334.940 Recovery = 103.94%								
Tl 190.801†	14.5	56.62	ug/L	4.713	56.62	ug/L	4.713	8.32%
QC value within limits for Tl 190.801 Recovery = 113.24%								
V 290.880†	1244.9	53.47	ug/L	1.071	53.47	ug/L	1.071	2.00%
QC value within limits for V 290.880 Recovery = 106.95%								

Zn 206.200†	42.8	55.14 ug/L	2.156	55.14 ug/L	2.156	3.91%

QC value within limits for Zn 206.200 Recovery = 110.28%

All analyte(s) passed QC.

Sequence No.: 7 **Autosampler Location: 12**
Sample ID: SEQ-IFA **Date Collected: 12/3/2014 11:34:56 AM**
Analyst: **Data Type: Original**
Initial Sample Wt: **Initial Sample Vol:**
Dilution: **Sample Prep Vol:**

Nebulizer Parameters: SEQ-IFA

Analyte	Back Pressure	Flow
All	249.0 kPa	0.80 L/min

Mean Data: SEQ-IFA

Analyte	Mean Corrected Intensity	Calib Conc.	Units	Std.Dev.	Sample Conc.	Units	Std.Dev.	RSD
Sc Axial	2109294.9	92.36	%	0.217				0.23%
Sc Radial	318797.4	93.67	%	1.050				1.12%
Ag 328.068†	-595.2	4.704	ug/L	0.5777	4.704	ug/L	0.5777	12.28%
QC value within limits for Ag 328.068 Recovery = Not calculated								
Al 396.153†	330112.1	60960	ug/L	751.2	60960	ug/L	751.2	1.23%
QC value within limits for Al 396.153 Recovery = 101.60%								
As 193.696†	-24.4	16.09	ug/L	47.499	16.09	ug/L	47.499	295.18%
QC value within limits for As 193.696 Recovery = Not calculated								
Ba 233.527†	29.5	-0.8114	ug/L	0.31033	-0.8114	ug/L	0.31033	38.25%
QC value within limits for Ba 233.527 Recovery = Not calculated								
Be 313.107†	50.7	-0.6066	ug/L	0.08128	-0.6066	ug/L	0.08128	13.40%
QC value within limits for Be 313.107 Recovery = Not calculated								
B 249.677†	-990.6	-129.3	ug/L	1.13	-129.3	ug/L	1.13	0.87%
QC value within limits for B 249.677 Recovery = Not calculated								
Ca 317.933†	583861.4	307000	ug/L	4419.2	307000	ug/L	4419.2	1.44%
QC value within limits for Ca 317.933 Recovery = 102.34%								
Cd 214.440†	8.7	-5.542	ug/L	1.1291	-5.542	ug/L	1.1291	20.37%
QC value less than the lower limit for Cd 214.440 Recovery = Not calculated								
Co 228.616†	32.7	4.493	ug/L	1.4040	4.493	ug/L	1.4040	31.25%
QC value within limits for Co 228.616 Recovery = Not calculated								
Cr 267.716†	-23.6	-1.129	ug/L	0.4635	-1.129	ug/L	0.4635	41.06%
QC value within limits for Cr 267.716 Recovery = Not calculated								
Cu 324.752†	-2424.4	-1.140	ug/L	0.3639	-1.140	ug/L	0.3639	31.91%
QC value within limits for Cu 324.752 Recovery = Not calculated								
Fe 238.204†	13218.9	237100	ug/L	2979.8	237100	ug/L	2979.8	1.26%
QC value within limits for Fe 238.204 Recovery = 94.85%								
K 766.490†	33.8	-87.83	ug/L	5.692	-87.83	ug/L	5.692	6.48%
QC value within limits for K 766.490 Recovery = Not calculated								
Mg 285.213†	711712.5	145900	ug/L	1631.6	145900	ug/L	1631.6	1.12%
QC value within limits for Mg 285.213 Recovery = 97.27%								
Mn 257.610†	244.5	-0.3270	ug/L	0.11880	-0.3270	ug/L	0.11880	36.33%
QC value within limits for Mn 257.610 Recovery = Not calculated								
Mo 202.031†	14.9	9.486	ug/L	1.6925	9.486	ug/L	1.6925	17.84%
QC value within limits for Mo 202.031 Recovery = Not calculated								
Na 589.592†	384444.1	51670	ug/L	359.4	51670	ug/L	359.4	0.70%
QC value within limits for Na 589.592 Recovery = 103.35%								
Ni 231.604†	100.3	4.035	ug/L	2.4513	4.035	ug/L	2.4513	60.76%
QC value within limits for Ni 231.604 Recovery = Not calculated								
Pb 220.353†	-25.7	15.12	ug/L	7.596	15.12	ug/L	7.596	50.23%
QC value within limits for Pb 220.353 Recovery = Not calculated								
Sb 206.836†	9.1	-9.310	ug/L	16.6909	-9.310	ug/L	16.6909	179.27%
QC value within limits for Sb 206.836 Recovery = Not calculated								
Se 196.026†	-5.2	-28.45	ug/L	54.672	-28.45	ug/L	54.672	192.16%
QC value within limits for Se 196.026 Recovery = Not calculated								
SiO2 251.603†	-199.8	25.89	ug/L	2.605	25.89	ug/L	2.605	10.06%
QC value within limits for SiO2 251.603 Recovery = Not calculated								
Sr 421.552†	45473.0	-2.050	ug/L	0.2950	-2.050	ug/L	0.2950	14.39%
QC value within limits for Sr 421.552 Recovery = Not calculated								
Ti 334.940†	139.9	0.729	ug/L	0.0411	0.729	ug/L	0.0411	5.64%
QC value within limits for Ti 334.940 Recovery = Not calculated								
Tl 190.801†	0.6	-9.196	ug/L	7.0740	-9.196	ug/L	7.0740	76.93%
QC value within limits for Tl 190.801 Recovery = Not calculated								
V 290.880†	702.6	-0.431	ug/L	1.8774	-0.431	ug/L	1.8774	435.53%
QC value within limits for V 290.880 Recovery = Not calculated								

Zn 206.200†	-1.3	-2.404 ug/L	1.1250	-2.404 ug/L	1.1250	46.80%

QC value within limits for Zn 206.200 Recovery = Not calculated
QC Failed. Continue with analysis.

Sequence No.: 8 **Autosampler Location: 13**
Sample ID: SEQ-IFB **Date Collected: 12/3/2014 11:38:37 AM**
Analyst: **Data Type: Original**
Initial Sample Wt: **Initial Sample Vol:**
Dilution: **Sample Prep Vol:**

Nebulizer Parameters: SEQ-IFB

Analyte	Back Pressure	Flow
All	248.0 kPa	0.80 L/min

Mean Data: SEQ-IFB

Analyte	Mean Corrected Intensity	Calib Conc.	Units	Std.Dev.	Sample Conc.	Units	Std.Dev.	RSD
Sc Axial	2110117.6	92.40	%	0.249				0.27%
Sc Radial	321726.6	94.53	%	1.093				1.16%
Ag 328.068†	17114.9	324.2	ug/L	0.11	324.2	ug/L	0.11	0.03%
QC value within limits for Ag 328.068 Recovery = 108.07%								
Al 396.153†	326855.3	60370	ug/L	929.2	60370	ug/L	929.2	1.54%
QC value within limits for Al 396.153 Recovery = 100.61%								
As 193.696†	73.7	1058	ug/L	25.1	1058	ug/L	25.1	2.37%
QC value within limits for As 193.696 Recovery = 105.85%								
Ba 233.527†	2467.2	296.6	ug/L	1.61	296.6	ug/L	1.61	0.54%
QC value within limits for Ba 233.527 Recovery = 98.87%								
Be 313.107†	31928.3	95.50	ug/L	0.570	95.50	ug/L	0.570	0.60%
QC value within limits for Be 313.107 Recovery = 95.50%								
B 249.677†	3053.5	398.6	ug/L	3.73	398.6	ug/L	3.73	0.94%
QC value less than the lower limit for B 249.677 Recovery = 79.73%								
Ca 317.933†	576348.5	303100	ug/L	5081.2	303100	ug/L	5081.2	1.68%
QC value within limits for Ca 317.933 Recovery = 101.02%								
Cd 214.440†	709.4	293.2	ug/L	1.73	293.2	ug/L	1.73	0.59%
QC value within limits for Cd 214.440 Recovery = 97.73%								
Co 228.616†	980.4	299.2	ug/L	0.07	299.2	ug/L	0.07	0.02%
QC value within limits for Co 228.616 Recovery = 99.74%								
Cr 267.716†	1321.8	293.5	ug/L	2.45	293.5	ug/L	2.45	0.83%
QC value within limits for Cr 267.716 Recovery = 97.84%								
Cu 324.752†	52099.5	311.3	ug/L	2.50	311.3	ug/L	2.50	0.80%
QC value within limits for Cu 324.752 Recovery = 103.78%								
Fe 238.204†	13131.7	235500	ug/L	2651.7	235500	ug/L	2651.7	1.13%
QC value within limits for Fe 238.204 Recovery = 94.22%								
K 766.490†	44993.8	20940	ug/L	107.0	20940	ug/L	107.0	0.51%
QC value within limits for K 766.490 Recovery = 104.71%								
Mg 285.213†	703098.3	144100	ug/L	2148.8	144100	ug/L	2148.8	1.49%
QC value within limits for Mg 285.213 Recovery = 96.09%								
Mn 257.610†	21949.9	197.6	ug/L	0.43	197.6	ug/L	0.43	0.22%
QC value within limits for Mn 257.610 Recovery = 98.78%								
Mo 202.031†	157.5	301.9	ug/L	2.99	301.9	ug/L	2.99	0.99%
QC value within limits for Mo 202.031 Recovery = 100.62%								
Na 589.592†	378889.5	50880	ug/L	841.7	50880	ug/L	841.7	1.65%
QC value within limits for Na 589.592 Recovery = 101.75%								
Ni 231.604†	785.0	299.2	ug/L	1.40	299.2	ug/L	1.40	0.47%
QC value within limits for Ni 231.604 Recovery = 99.73%								
Pb 220.353†	427.4	1003	ug/L	8.9	1003	ug/L	8.9	0.89%
QC value within limits for Pb 220.353 Recovery = 100.28%								
Sb 206.836†	247.9	977.6	ug/L	22.50	977.6	ug/L	22.50	2.30%
QC value within limits for Sb 206.836 Recovery = 97.76%								
Se 196.026†	34.2	468.2	ug/L	27.62	468.2	ug/L	27.62	5.90%
QC value within limits for Se 196.026 Recovery = 93.64%								
SiO2 251.603†	1655.9	482.6	ug/L	1.68	482.6	ug/L	1.68	0.35%
QC value within limits for SiO2 251.603 Recovery = 96.53%								
Sr 421.552†	3138744.4	1002	ug/L	5.1	1002	ug/L	5.1	0.51%
QC value within limits for Sr 421.552 Recovery = 100.22%								
Ti 334.940†	196828.8	1026	ug/L	3.8	1026	ug/L	3.8	0.37%
QC value within limits for Ti 334.940 Recovery = 102.58%								
Tl 190.801†	248.9	943.5	ug/L	20.26	943.5	ug/L	20.26	2.15%
QC value within limits for Tl 190.801 Recovery = 94.35%								
V 290.880†	7864.5	306.3	ug/L	2.18	306.3	ug/L	2.18	0.71%
QC value within limits for V 290.880 Recovery = 102.09%								

Zn 206.200†	222.8	282.4 ug/L	6.85	282.4 ug/L	6.85	2.43%

QC value within limits for Zn 206.200 Recovery = 94.13%
QC Failed. Continue with analysis.

Sequence No.: 9
Sample ID: 1412020-BLK1
Analyst: S.VanOvermeiren
Initial Sample Wt:
Dilution:

Autosampler Location: 26
Date Collected: 12/3/2014 11:42:28 AM
Data Type: Original
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: 1412020-BLK1

Analyte	Back Pressure	Flow
All	248.0 kPa	0.80 L/min

Mean Data: 1412020-BLK1

Analyte	Mean Corrected Intensity	Calib Conc.	Calib Units	Std.Dev.	Sample Conc.	Sample Units	Std.Dev.	RSD
Sc Axial	2323396.3	101.7	%	0.35				0.34%
Sc Radial	342151.3	100.5	%	1.14				1.14%
Ag 328.068†	6.2	0.1121	ug/L	0.07670	0.1121	ug/L	0.07670	68.44%
Al 396.153†	-3.8	-0.7591	ug/L	1.00413	-0.7591	ug/L	1.00413	132.28%
As 193.696†	0.2	2.294	ug/L	16.7939	2.294	ug/L	16.7939	732.07%
Ba 233.527†	-0.1	-0.0106	ug/L	0.16986	-0.0106	ug/L	0.16986	>999.9%
Be 313.107†	149.1	0.4499	ug/L	0.04821	0.4499	ug/L	0.04821	10.72%
B 249.677†	13.3	1.733	ug/L	0.2537	1.733	ug/L	0.2537	14.64%
Ca 317.933†	25.4	13.36	ug/L	2.543	13.36	ug/L	2.543	19.03%
Cd 214.440†	0.7	0.2849	ug/L	0.62669	0.2849	ug/L	0.62669	219.93%
Co 228.616†	-0.5	-0.1589	ug/L	0.86141	-0.1589	ug/L	0.86141	542.09%
Cr 267.716†	1.6	0.3479	ug/L	0.57958	0.3479	ug/L	0.57958	166.60%
Cu 324.752†	-248.1	-1.418	ug/L	0.0484	-1.418	ug/L	0.0484	3.41%
Fe 238.204†	3.0	53.66	ug/L	43.271	53.66	ug/L	43.271	80.64%
K 766.490†	50.0	23.33	ug/L	4.493	23.33	ug/L	4.493	19.26%
Mg 285.213†	-27.3	-5.582	ug/L	1.6504	-5.582	ug/L	1.6504	29.56%
Mn 257.610†	-10.1	-0.0918	ug/L	0.00752	-0.0918	ug/L	0.00752	8.19%
Mo 202.031†	0.7	1.390	ug/L	4.1416	1.390	ug/L	4.1416	297.85%
Na 589.592†	80.5	10.82	ug/L	0.868	10.82	ug/L	0.868	8.02%
Ni 231.604†	1.5	0.6129	ug/L	0.73757	0.6129	ug/L	0.73757	120.35%
Pb 220.353†	1.4	3.010	ug/L	2.8189	3.010	ug/L	2.8189	93.66%
Sb 206.836†	-0.4	-1.509	ug/L	2.7320	-1.509	ug/L	2.7320	181.04%
Se 196.026†	-0.4	-5.417	ug/L	13.5300	-5.417	ug/L	13.5300	249.76%
SiO2 251.603†	-142.7	-39.85	ug/L	0.707	-39.85	ug/L	0.707	1.77%
Sr 421.552†	72.4	0.020	ug/L	0.0102	0.020	ug/L	0.0102	50.51%
Ti 334.940†	3.9	0.020	ug/L	0.0227	0.020	ug/L	0.0227	112.28%
Tl 190.801†	0.6	2.210	ug/L	7.1023	2.210	ug/L	7.1023	321.37%
V 290.880†	-130.4	-5.605	ug/L	0.2217	-5.605	ug/L	0.2217	3.96%
Zn 206.200†	0.7	0.962	ug/L	1.4341	0.962	ug/L	1.4341	149.01%